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ELECTRICAL WORLD

APRIL 19, 1930
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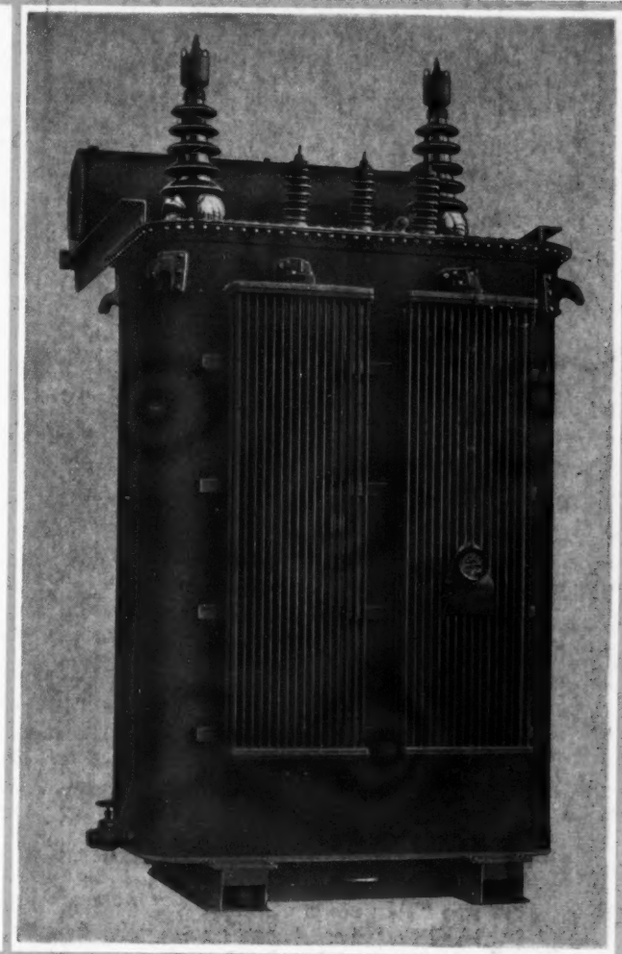

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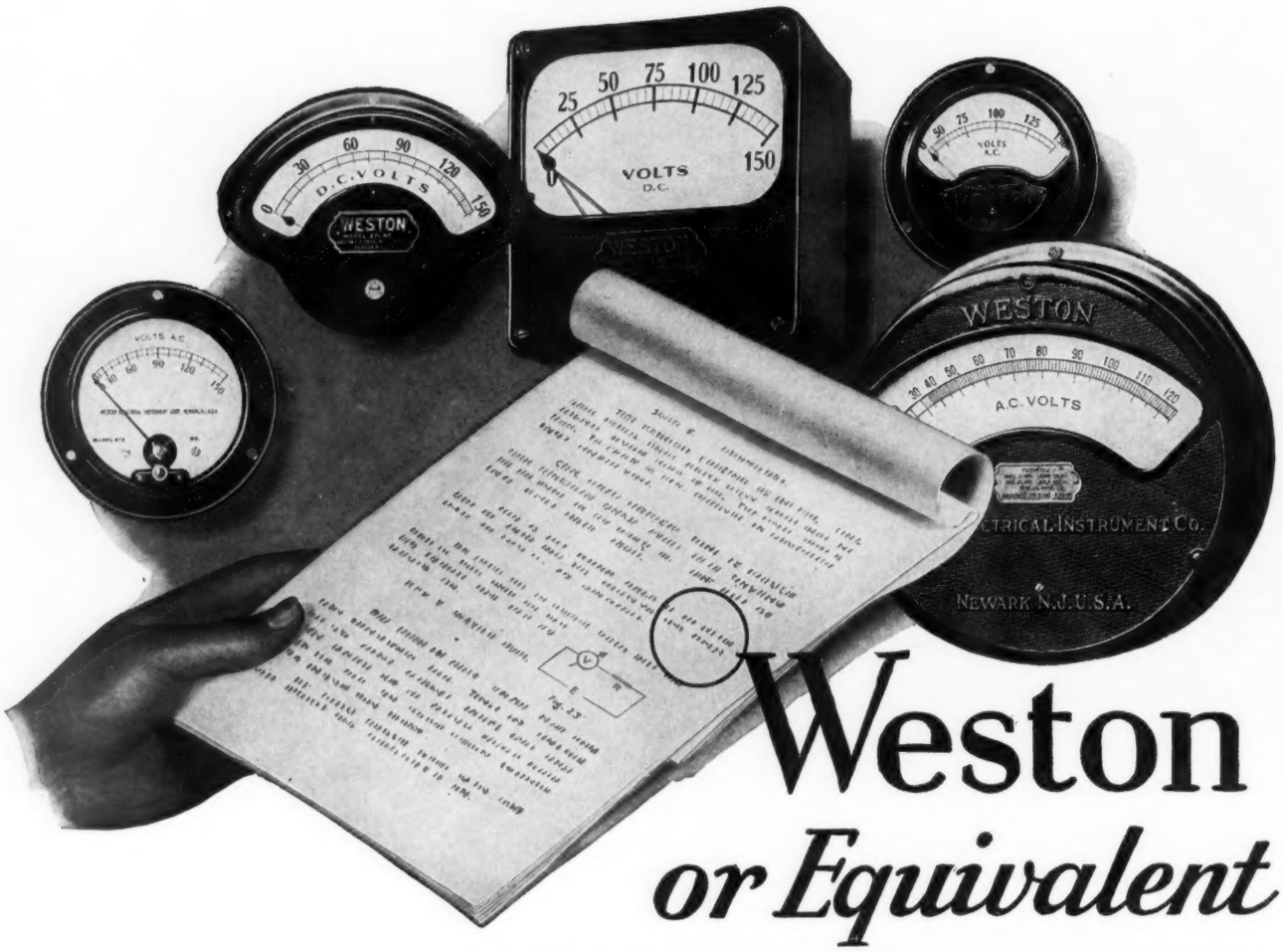
St. Louis Missouri



Weston
or Equivalent

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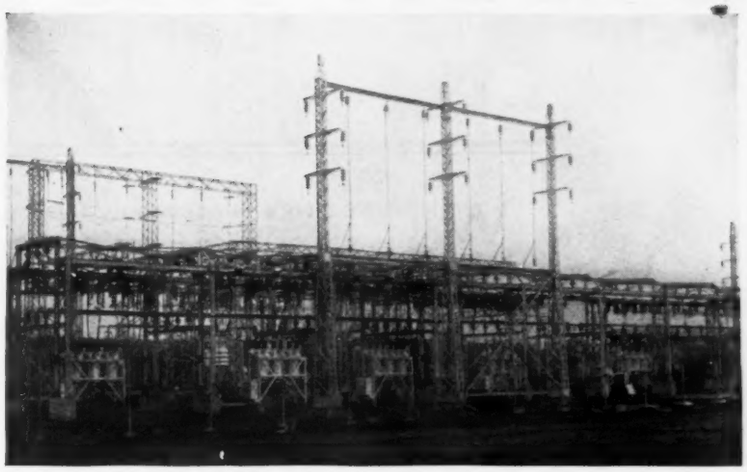

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ELECTRICAL WORLD

for the Week Ending

April 19, 1930

Copper Drops from 18 to 14 Cents

Two-Way Television Demonstrated

Leaders Differ on Utility Regulation

Albany Public Service Bills Await Governor's Action

Electric Bond & Share Case up This Week

—TWO-WAY TELEVISION is an unqualified success. In course of time commercial installations will permit subscribers to see as well as to hear each other.

—VALUATION and rate-contract bills revising New York State utility regulation are in the hands of Governor Roosevelt. A veto is probable. Regulation will be an issue in the fall political campaign.

—MUSCLE SHOALS legislation passed by the Senate is rejected by the House. Apparently another session of Congress will come to an end with no action on Muscle Shoals upon the statute books.

—FROM 18 TO 14 CENTS is the drop in the price of copper. This means a saving of $40,000,000 to the electrical industry this year.

—ENGINEERING details for Boulder Dam are having final study from two separate groups of experts in Denver. Add to the political controversy engineering differences between the Colorado River Commission and the Boulder Dam Board.

—ONTARIO'S Hydro-Electric Commission is buying or expects to buy upward of 1,000,000 hp. from plants in the north of the province and in Quebec across the provincial boundary. The price to be paid is reported to average about $20 per horsepower.

—SPRING MEETINGS are many. San Francisco is preparing a blazing welcome for the N.E.L.A. in June, Toronto will welcome the A.I.E.E., and Berlin is preparing for 3,000 delegates to the World Power Conference.

—EASY MONEY conditions have caused the uninterrupted advance in the stock market, but judging from the earnings statements for the first quarter, business has not improved sufficiently to warrant the gain in market prices.

—TAXES take 10 per cent of light and power company revenues.

—THE WORLD'S highest tariff wall has been erected by Australia. A large proportion of the $150,000,000 business we did with her was electrical.

—FOUR OUT of the five most popular stocks held by investment trusts are those of electric utilities.

NEWS OF THE WEEK

House Will Have a New Shoals Bill—Variations on Familiar Themes

MUSCLE SHOALS, the Federal Trade investigation, reorganization of the Power Commission, Boulder Dam, Flathead Lake—these are the well-worn topics around which this week's Washington news is built. Fortunately, they permit of variation, and occasionally a new participant gets his chance to perform before the political microphone.

•

The unexpected happens in House action on Muscle Shoals

All old Muscle Shoals bills, including the Norris plan, are to be abandoned according to a surprise decision reached by the House committee on military affairs on April 15. A subcommittee of five has been appointed to draft a bill for disposal by lease and to report next Tuesday. As Senator Norris probably is in a position to block a private leasing bill in the Senate, indications are that there will be no Muscle Shoals legislation at this session.

It is probable that the new bill will be closely similar to the one introduced in the House on the same day by Lewis W. Douglas, Representative-at-Large for Arizona, who has been appointed a member of the drafting subcommittee. Mr. Douglas is an engineer and an avowed opponent of government ownership. Presidential leasing of Muscle Shoals for a term not to exceed 50 years is provided in this bill, which aims at insuring as nearly as possible a fair return on an amortization of the government's investment. It would permit the lessee to build Cove Creek Dam under the federal water-power act. A maximum use of all project power would go into the production of fertilizers, ferro-alloys and other products.

When the committee resumed its hearings a string of witnesses appeared to give expert advice on the fertilizer phase. Charles J. Brand, executive secretary of the National Fertilizer Association, said that no great fertilizer price reduction such as has been held out by farm leaders is to be expected by the operation of Muscle Shoals on any basis. Already, he pointed out, the rise of the American nitrogen industry has helped to reduce domestic prices and to break the Chilean monopoly. Ranking chemists from the federal service testified that, inasmuch as the Shoals are no longer essential to national defense as brought out previously by the Chief of Ordnance, the properties should be liquidated as soon as possible by sale to the private firm which can make the best offer.

•

Trade Commission delves into Bond & Share matters

Inquiry by the Federal Trade Commission into the business of the Electric Bond & Share Company started on Wednesday of this week, with no company witnesses testifying and the commission doing the best it could with such evidence as it could scrape together. Engineer-examiner Judson C. Dickerman played a leading part, as in the American Gas & Electric hearings, with a detailed and well-organized analysis of the company system.

Bond & Share operates with subsidiary utility companies in nearly half the states of the Union. Its main member companies are: American Power & Light Company, with twenty-five subsidiaries in twelve states; Electric Power & Light Corporation, with seventeen subsidiaries in seven states; National Power & Light Company, with eleven subsidiaries in four states, and Lehigh Securities Company, with three subsidiaries in Pennsylvania. As contrasted with the A. G. & E. group, analyzed in the March 22 issue of the ELECTRICAL WORLD, the

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REVOLUTION MEANINGLESS TO STROBOGLOW

—P. & A. Photos.

When rays from the "stroboglow" (small enough to go in a suitcase) are turned upon any revolving or oscillating object, the latter appears to stand still and vibration or injury becomes apparent. The device, a Westinghouse invention due to D. D. Knowles, L. R. Peters and W. E. Bahles, contains a neon lamp which flashes just as many times a minute as, for instance, the airplane propeller shown above revolves—in this case 1,000.

main difference is that the Bond & Share diversifies into fields other than power utilities. Aside from electric power, electric railways and manufactured and natural gas, the group does a minor business in steam heating, water, ice, telephone and merchandising operations. More important are its security holdings in a wide range of businesses, including banks, insurance, industrial, and others. A large foreign business is carried on by the subsidiary American & Foreign Power Company.

Management is a main feature. As compared with the A. G. & E., the Bond & Share probably has twice the staff per volume of business. Bond & Share does about three times as much business as the A. G. & E. and its staff is six times as large, about 1,500.

•

Boulder Dam contracts hang fire

The Boulder Dam issue still hangs fire pending signatures on power contracts under the plan announced last month. There have been further conferences in California to settle such matters as how the 6 per cent of the total power allocated among eleven municipalities is to be divided. Legal phases of the individual bids also are being adjusted. The completion of contracts which will guarantee the use of all power developed at Boulder Dam seems to be only a matter of days.

•

Walsh for Flathead development

A left-handed indorsement of the Montana Power Company's Flathead project application was given in the Senate on Friday of last week by Senator Walsh of Montana, who pointed out that the Montana Power is the only applicant for actual development and that the Federal Power Commission has been discussing royalty terms. However, negotiations are ended for the present because the company declines to accept the basis proposed. The offer from William H. Wheeler of Minneapolis is for a permit to investigate.

•

Couzens Power Commission bill is reported by Senate committee

An amended bill to reorganize the Federal Power Commission was reported April 11 by the Senate committee on interstate commerce under the chairmanship of Senator Couzens. This is not the "big bill," seeking to control all interstate power, but simply a bill to create an independent power commission. Three presidential appointees at $10,000 per year would supplant the Secretaries of War, Interior and Agriculture in administering the water-power act. Terms of office would be six years with expirations staggered to insure continuity of experienced direction. A new clause allows incidental assistance from the three departments by providing for the assignment of civil service personnel for work outside of Washington.

The measure has received preference on the Senate calendar and is likely to come to a vote within a few days. Since the Senate has not been particularly responsive to the desires of the administration, none would be surprised were the measure to pass that body. In the House the leaders are expected to oppose the bill, and chances are against its being brought to a vote there.

The Parker bill, described last week, has been referred to the government departments concerned for their recommendations.

•

National Hydraulic Laboratory bill passes both houses

Despite formidable opposition, the House has passed a bill to establish a National Hydraulic Laboratory. A similar bill had been passed by the Senate, and the conference committee will reconcile discrepancies. Army engineers are said to have changed their attitude to one favoring such a bureau, and the sponsors of the bill point out that President Hoover is on record as strongly in favor of such a laboratory at the Bureau of Standards. Engineers throughout the country have been virtually unanimous in indorsing the measure. A total expenditure of $350,000 is authorized for the construction of a suitable building and for the provision of equipment.

SPRING'S TREE TRIMMING HERE AGAIN

—F. A. Bartlett Tree Expert Company.

In insuring proper clearance for public utility transmission lines which pass through or past trees safety rules are doubly important

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Washington Will Look Into Radio Combination

FULL investigation of the plan of the Radio Corporation of America to take over the radio activities of the General Electric Company and the Westinghouse Electric & Manufacturing Company will be made by the Department of Justice at Washington, according to a statement given to the press by that department. The statement followed the announcement that, under the reorganization plans, the General Electric and Westinghouse will control jointly the Radio Corporation of America through ownership of 51.3 per cent of the voting power, following the issuance to them of additional shares.

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Albany Utility Bills in Governor's Hands

REPUBLICAN leaders in the New York Legislature arrived at a compromise with their rebellious followers from Buffalo and Rochester on Friday night, April 11, under which amendments to the valuation and rate-contract utility bills satisfactory to both the leaders and the recalcitrants were put through just prior to final adjournment of the law-making body.

The bill amending the Public Service Commission law in relation to a statewide valuation was itself amended to

provide that valuations shall be taken only in cases where there is a controversy. The present powers of the commission are somewhat broadened under the amended bill, and with the bills previously passed setting up a valuation bureau and making appropriation for its expenses the commission will be in position to make valuations promptly. When the valuation is finished the municipality, with the utility company, becomes a party to the proceedings to determine the fairness of the valuation.

The contract bill was amended to provide that any municipality may enter into a contract with a utility company for a given term of years on a service-at-cost plan to be approved by the commission. The language of this amendment is fashioned after the language of the law relating to the service-at-cost plan for street railways now in operation at Rochester.

The bill relating to submetering referred to last week (page 722) was also passed. These measures, together with the other amendments to the Public Service Commission act previously passed, were still in the hands of the Governor when the ELECTRICAL WORLD went to press. He was thought likely to veto the bills on which the Knight investigating commission set most stress. In the Governor's view they are not adequate.

Virginia Now Member of Southeast Association

WITH a registration of 450, the Southeastern Division of the National Electric Light Association held its eighteenth annual convention at Augusta, Ga., on April 15 to 17. Within the past five weeks the State of Virginia, on invitation of the Southeastern Division and with approval of the executive committee of the N.E.L.A., has become affiliated with the Southeastern Division. The Virginia delegation was formally welcomed by H. E. Cox, first vice-president of the division.

A feature of the Engineering Section meeting was a paper on lightning arrester characteristics, with a miniature high-voltage lightning generator demonstrating the practical application of the Braun tube in depicting the changes in voltage at the time of electric disturbances, especially those that occur in the proximity of line insulators. Demonstrations were handled by E. W. Beck of the Westinghouse company and W. W. Lewis of the General Electric.

Before the Commercial Section M. H. Furbringer, member of the American Institute of Architects, spoke on the correlation of architecture and electrical advertising display. He made the suggestion that the N.E.L.A. sponsor some sort of a competition among architects along this line. At the public relations session Clark Belden spoke on "The Mechanics of Public Relations."

"While recovery has not yet taken place uniformly, business in general is well back in its stride and all fear of a continued and widespread depression has vanished," Matthew S. Sloan, president of the N.E.L.A., declared in his address on Thursday morning. After summarizing what electricity has accomplished, Mr. Sloan continued:

> Although lighting at best is only 17 per cent of the minimum level recommended, it is the chief application of electricity in homes. Many applications now in only occasional use should acquire more constant use. We should, therefore, by every means in our power further the wider use of electricity in homes. A very important part of our effort, I believe, must be a general lowering of prices for domestic use. . . . Lowered rates, however, are not possible without lowered costs and increasing sales. . . . Our job must continue to be the seeking of ways and means to make it cheaper to use electricity than not to use it, if we are to do our full part in electrifying America. Our problem then is the further refining of methods for effecting economies in operation and administration —by technical proficiency, by the economies all along the line which consolidations and holding-company groupings offer, and by any other way the future may show.

Incoming officers are: President, H. E. Cox, Birmingham Electric Company; vice-presidents, J. C. Guild, Jr., Tennessee Electric Power Company; L. A. Magraw, South Carolina Power Company, and J. H. Hancock, Appalachian Power Company.

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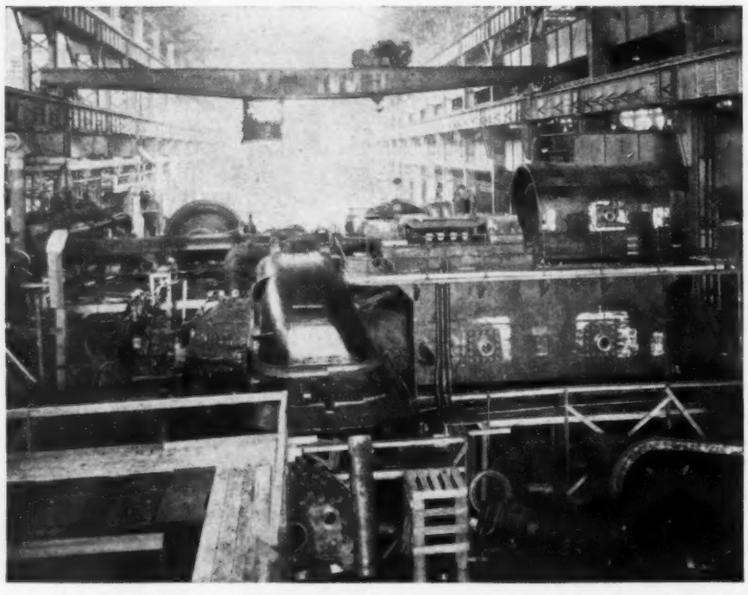
THE NEW VERTICAL TYPE OF TURBINE



A new type of vertical-compound turbo-generator is being erected for test in the Schenectady works of the General Electric Company. It is the first of two such 50,000-kw. units for the Pacific Gas & Electric Company. The 1,200-lb. high-pressure turbine and generator are mounted on top of the generator of the low-pressure element. This machine was described and illustrated in the ELECTRICAL WORLD *for May 25, 1929 (page 1066).*

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Final Decree Issued in Chicago's Diversion Suit

JUDGMENT has been rendered in the suit of various states which border on the Great Lakes to restrain the Chicago Sanitary District from continuing to divert water from Lake Michigan, thus lowering lake levels and, among other things, affecting the possible production of hydro-electric power.

The United States Supreme Court, which had previously appointed Charles E. Hughes as master to take evidence and which last December received his report (ELECTRICAL WORLD, December 21, 1929, page 1238), entered its final decision on Monday of this week, incorporating in it, in the main, the recommendations of Mr. Hughes. The latter, now Chief Justice of the Supreme Court, of course had no part in rendering the decree, which was written by Justice Holmes.

The decision criticises the State of Illinois and the Chicago Sanitary District for "persisting in unjustifiable acts," and warns them that they "must find a way out at their own peril." The

court orders a gradual decrease in diversion of water from Lake Michigan until 1938, when it expects that Chicago will have completed her sewage-disposal plant. The nine-year period allowed for construction of the sewage disposal plant is three years less than Chicago asked and four years more than the plaintiffs wished to concede.

The decree leaves the way open for either side to apply to the court later for action or relief if its terms are found too stringent or too liberal. The court retains jurisdiction.

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Preliminary Calendar for N.E.L.A. Convention

NO DETAILED program of the fifty-third convention of the National Electric Light Association, to be held at San Francisco in June, is yet available, but the officers of the association have drawn up a preliminary calendar which gives the main sessions and events in outline. Registration will open on Saturday afternoon, June 14, and be continued on Sunday afternoon and on all the subsequent days. As previously announced, there will be no manufacturers' exhibition. All business sessions will be held in the Exposition Auditorium, Civic Center, in the heart of San Francisco. These sessions will be as follows:

MONDAY, JUNE 16

Pacific Coast Electrical Association convention in morning.
National women's committee meeting, 10:30 a.m.
San Francisco Electrical Development League luncheon, 12 noon, Palace Hotel.
National executive committee meeting, 1:30 p.m., Palace Hotel.
Executive committee meetings of the four sections, 3 p.m., Palace Hotel.
National employee speaking contest elimination in afternoon. President's reception, 9 p.m., followed by dancing.

TUESDAY, JUNE 17

First general session, 10 a.m.
Accounting National Section, 3 p.m.
Engineering National Section, 3 p.m.

WEDNESDAY, JUNE 18

Second general session, 10 a.m.
State public utility information directors' luncheon-meeting, 1 p.m., Palace Hotel.
Commercial National Section, 3 p.m.

THURSDAY, JUNE 19

Third general session, 10 a.m.
Public policy committee luncheon-meeting, 1 p.m., Palace Hotel.
Public Relations National Section, 3 p.m.
Finals and awards in national employee speaking contest.
Public policy committee session, 8:15 p.m. Public invited.

FRIDAY, JUNE 20

Fourth general session, 10 a.m.
Convention adjournment about 1:30 p.m.

San Francisco is preparing literally to blaze a welcome to the convention throng. Elaborate illumination of the downtown section, the Civic Center, Golden Gate Park and the ocean beach is planned. Many impressive displays are promised, providing a greeting to visitors and a symbol of the industry.

WEST COAST HAS 30 GIANT BEACONS

—Wide World Photos.

Newly completed, the Richfield Building in Los Angeles carries a 40,000,000-cp. airway beacon on top of its 125-ft. tower, built like an oil derrick. Thirty similar lights are spaced every 50 miles along the coast from Mexico to Canada.

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U.G.I. and P.S. of N.J. Contradict Merger Rumor

NEWSPAPER stories of negotiations for a merger of the United Gas Improvement Company and the Public Service Corporation of New Jersey brought forth the following statement which was issued at Philadelphia on April 11:

"According to John E. Zimmermann, president of the United Gas Improvement Company, and Thomas N. McCarter, president of the Public Service Corporation of New Jersey there is no truth in the articles appearing in this morning's press that negotiations are under way leading to a merger of the United Gas Improvement Company and the Public Service Corporation of New Jersey. Relations between the Public Service Corporation and United Gas Improvement have for many years been very close, but there have been no discussions leading to a merger."

The United Gas Improvement Company in its annual report on April 2 revealed that it had acquired additional shares of the Public Service Corporation through an investment of $17,762,004, bringing its total holdings up to 1,807,206 shares on December 31, 1929. This constituted almost 34 per cent of the common stock of the latter corporation.

▼

Ontario Premier States Hydro Plans in North

COMPLETION of arrangements by the Ontario Hydro-Electric Power Commission for the development of the Mississagi River water power sites as the chief source of supply for the Sudbury district was announced by Premier Ferguson in the Legislature on March 20. The Mississagi sites will produce 100,000 hp. Immediate requirements in the Sudbury area from two places alone call for 70,000 hp., and within six months another large mine will subscribe for 20,000 hp., the Premier stated.

Negotiations now being conducted by the Ontario Hydro will clear up all differences in the case of the Montreal River power sites which were so acute two years ago. For the development of the Sudbury district power sites the Legislature voted $1,300,000. Of this $1,000,000 will be spent on actual development and the balance for transformer stations and power lines.

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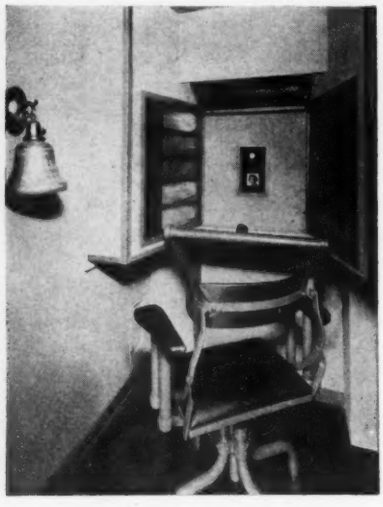
Ontario Hydro Buys 100,000 Hp. from Abitibi

PURCHASE by the Ontario Hydro-Electric Power Commission of 100,000 hp. of electrical energy from the Hudson's Bay Power Company, a subsidiary of the Abitibi Power & Paper Company, has been announced by the provincial government. The contract involves the building by the Abitibi company of a twenty-three-million-dollar development on the Abitibi River, 63 miles north of Cochrane, and the construction by the Hydro of a transmission line to Sudbury, where the new power will be available at $22 to take care primarily of the ever-increasing expansion in mining operations. It is estimated that the transmission line will cost $3,500,000. Completion of the development and delivery of power are expected in the late fall of 1931.

Adding this purchase of 100,000 hp. to the 250,000 hp. to come from the Beauharnois Light, Heat & Power Company of Montreal, the 260,000 hp. from the Gatineau River plants of the International Paper Company and other contemplated purchases, a total of approximately 1,000,000 hp. will be reached. For the Quebec power $15 a horsepower will be paid, and an average price of about $20 is indicated for the whole amount to be bought.

A. T. & T. Demonstrates Two-Way Television

TELEVISION has taken one more step in its development with the production of a system of two-way transmission which can replace the usual two-way telephone, permitting the parties to a conversation to see as well as to hear each other. An experimental service between the American Telephone & Telegraph Company's building at 195 Broadway and the Bell Telephone Laboratories at 463 West Street, New York, which has been in operation for some time, was last week disclosed and demonstrated to representatives of the daily and technical press. Special telephone booths were installed at these two buildings and equipped with television transmitters and receivers, designed by the Bell Telephone Laboratories, which have been pursuing very active research in television ever since their demonstration in 1927 of its scientific practicability.



The demonstration was an unqualified success. Great improvement in the television image was manifested over that originally demonstrated by the Bell Telephone Laboratories in 1927. It is about twice as large, with corresponding increase in detail. The image, which has the detail of about 5,000 discrete points of light, is formed eighteen times a second. The photo-electric cells have been much improved in sensitiveness and give rise to about ten times the current for the same amount of light that those developed for the earlier demonstration did. That increased sensitivity and the use of a blue scanning beam have made possible the reduction of the glare which occurred to a certain extent in the earlier forms of apparatus.

The person whose image is being transmitted is virtually unconscious of the fact that his face is being swept eighteen times a second by a scanning beam of light, and the beam is not bright enough to interfere with his seeing the image of the person to whom he is talking. At the same time the television image has been made much brighter and sharper by the development of the higher-powered water-cooled neon tubes. The increased area and detail of the image necessitate the use of a wide band of frequencies, and the circuits between the Broadway and West Street buildings have been adapted to the transmission of a frequency band of 40 kilocycles.

Dr. F. B. Jewett, president Bell Telephone Laboratories, is shown seated in the left-hand illustration, with Dr. Frank Gray of the Laboratories standing beside him. The right-hand picture is an excellent representation of the method followed. In the lower part of the opening one sees an image of the person at the distant end. From a point just above it the scanning beam is directed to the face of the speaker, and the reflected light is picked up by photo-electric cells visible through the glass plates at sides and top.

On account of its complexity and cost, the officials said, no immediate commercial application of telephonic television is anticipated, whatever future development may warrant.

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First Unit of Stourport Plant in England Installed

FINANCED by the Utilities Power & Light Corporation of Chicago, the first unit of a generating plant that will eventually be rated at 100,000 kw. and cost $10,000,000 has been finished at Stourport, England. It is being built for the Shropshire, Worcestershire & Staffordshire Electric Power Company, which is one of the 30 subsidiaries of the Utilities Power & Light Corporation. The American company plans to expend approximately $40,000,000 more for similar projects in England during the next four years.

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Rural Service Gains in New England

FARM customers to the number of 7,389 were added to the systems of 48 leading power companies in New England during 1929, according to a report of the New England Council's farm power committee at a recent quarterly meeting in Providence. In the absence of Chairman Samuel Ferguson, F. A. Belden of the Boston Edison company reported for the committee that 1,258.9 miles of rural lines were built last year, broken down by states as follows:

State	Miles Rural Line	New Customers on Such Lines
Maine	501.40	2,964
New Hampshire	158.68	1,428
Vermont	91.73	441
Massachusetts	233.23	1,465
Rhode Island	8.31	73
Connecticut	265.60	1,018

The committee said that a better understanding of the rural user's viewpoint has grown up of late among the power companies and that New England's farm population has also acquired a better appreciation of the problems involved in line extensions.

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Insull Indiana Interests Want Compact Territories

PETITIONS have been filed with the Indiana Public Service Commission asking authority for the purchase and sale of properties by the Northern Indiana Public Service from and to the Interstate Public Service Company. The proposals, if approved, will be in the interest of compact service areas. Both companies are Insull properties, subsidiaries of the Midland Utilities Company.

The Northern Indiana Public Service Company proposes to purchase from the Interstate properties in what are known as the Goshen-Warsaw and Monticello districts. These districts at present are virtually surrounded by territory served by the Northern Indiana Public Service Company, and approval of the transaction will give the latter company a territory directly across the northern part of the state. The Interstate proposes to purchase from the Northern Indiana properties in what are known as the Lafayette-Frankfort, Lebanon and Crawfordsville districts. These districts are in the same general territory already served by the Interstate.

Spier Falls to Have 57,000-Hp. Generator

AMONG the largest water-driven machines anywhere, both as to capacity and physical size, will be the 57,000-hp. G. E. generator to be installed this year in the station of the New York Power & Light Corporation at Spier Falls, on the Hudson River. At present the Spier Falls station has eight waterwheel generating units, but the newcomer will have a greater capacity than the eight together. Only the generators at Niagara Falls and at Conowingo will, according to the General Electric Company, exceed this new Spier Falls machine in this country. Its electrical capacity, 47,000 kva., puts it second among the three, as those at Niagara are 65,000 kva. and those at Conowingo are 40,000 kva. Its height, 24 ft. 2 in., puts it third, the Niagara units being 26 ft. 6 in. high and those at Conowingo 33 ft. 2 in. In weight it is also third. In over-all diameter, however, it stands first, measuring 43 ft. across. The diameter of the Niagara units is 31 ft. 10 in. and those at Conowingo measure 37 ft. 4 in.

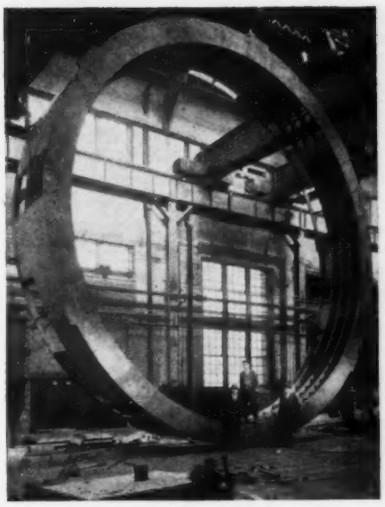
The frame for the stationary element, shown here, is being made in six sections at Schenectady. It will be shipped unassembled and without the coils and windings to insure sufficient clearance and reduce weight. The machine is to be ready for service by December 1. The waterwheel which will drive it will be the largest ever built, it is asserted.

The Spier Falls station is about 15 miles downstream from the Sacandaga Reservoir, built by the Hudson River Regulating District created under state law, to be paid for by assessments levied upon beneficiaries. Spier Falls will be the largest installation to profit from the storage development. Other plants of the Niagara-Hudson system, of the International Paper & Power Company and of several industrial companies will be able to increase their capacity as a result of the completion of the reservoir.

The Sacandaga Reservoir, formed by the Conklingville Dam, is 27 miles long and 3,000 to 28,000 ft. wide, with an area of 42.3 square miles. Its huge storage capacity will provide a regular all-season supply of water power for hydro-electric stations many miles downstream.

A 30,000-hp. plant is being built at Conklingville, just below the dam, which will be ready for operation when the reservoir has filled up next spring. The potential capacity of the site is many times the initial capacity being installed.

A 110-kv. transmission line will be built from Conklingville to tie in with a circuit running from Whitehall on Lake Champlain to Spier Falls, whence a double steel-tower circuit at 110,000 volts connects Feeder Dam, Sherman Island and Spier Falls power stations



with Rotterdam Junction, a few miles west of Schenectady. Rotterdam Junction is the nerve center for north-south and east-west power lines in east-central New York State.

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Ohio and Oregon to Have New Rural Rules

FARM organizations and electric utilities in Ohio have accepted a service agreement drawn up by a committee appointed by the two groups at the suggestion of Governor Cooper, and it will soon be put in operation by an order from the Public Utilities Commission. Under the plan adopted rural districts adjacent to power lines of less than 15,000 volts will be supplied with electrical energy on a minimum guaranteed consumption basis. Where it is necessary to extend lines the consumer will be asked to pay a monthly charge equal to 2 per cent of the money spent for the extension. The utility, however, will assume the cost of maintaining the lines, which will be constructed within six months after the farmer's contract for service is made. No initial payment will be required for the line service. Utility companies in the agreement include the Union Gas & Electric Company of Cincinnati, the Pennsylvania-Ohio Power Company, the Dayton Power & Light Company and the Northern Ohio Power & Light Company.

In a revised schedule of rules and regulations governing the construction of electric extension lines in Oregon, the Public Service Commission recommends that any extension costing not more than $75 a customer, or not more than three times the estimated annual revenue immediately available from said extension, be constructed as a free investment by the company concerned. This new rule is intended as a substitute for the utilities' present practice of charging for extension construction costs exceeding $60.

The proposed rules also provide that charges for single-phase primary-voltage distribution lines for voltages up to and including 6,600 shall be $600 per mile and that for voltages in excess of 6,600 the charges shall be $800 per mile. The department also recommends that during a period of five years from date of commencement of service on any extension built for which the present customers or their predecessors have made advance revenue payments all other applicants for connection to this particular extension shall pay to the present users a pro rata share of advance revenue payments less adjustments, if any, provided that the cost of additional construction to connect such applicants shall require no advance payments or shall require average advance payments of less amounts than those paid by the original users of the extension service.

The commission is holding a series of hearings in regard to these proposed changes in extension regulations.

Operating Data on 170 Systems

Operating statistics of 170 large electric public utility systems in the United States, Canada and Mexico are to be issued soon in the form of a supplement to the ELECTRICAL WORLD.

A few copies of similar supplements for the years 1927 and 1928, heretofore sold separately at $1 each, are still available and will, until the supply is exhausted, be sent gratuitously to subscribers, upon receipt of a request addressed to the statistical editor.

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Boulder Dam Details Are Studied in Denver

STUDY of the final engineering details of Boulder Dam began in Denver on April 10, two separate groups of experts working behind closed doors in different rooms at the United States Reclamation Bureau offices. In one of these rooms the Colorado River Commission, appointed by the Secretary of the Interior before the passage of the bill, assembled for a ten-day session. All five members were present, these being Prof. Charles P. Berkey of Columbia, Profs. D. W. Mead and W. J. Mead, both of Wisconsin; Robert Ridgway of New York and Major-General W. L. Sibert, the chairman. In the other room Raymond F. Walter, chief engineer of the Reclamation Bureau at Denver; D. C. Henry of Portland, Ore.; Louis C. Hill of Los Angeles and A. J. Wiley of Boise, constituting the Boulder Dam Board, were in session.

MARCONI'S "FIAT LUX"

—*Wide World Photos.*

Here is Senator Guglielmo Marconi, on board his yacht in the harbor of Genoa, Italy, talking to the Mayor of Sydney, Australia, before pressing a button to turn on thousands of electric lamps in the Antipodes.

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Salem, Mo., Succeeds in Ousting Company

SALEM, MO., has succeeded in a fight with the company that previously furnished it with electricity. This case attracted wide attention. The Missouri General Utilities Company has now abandoned its fight against ouster and plans to withdraw from that community, where it has been competing with a municipal plant since last October.

Soon after the city-owned plant began operations the utility company filed a schedule of rates with the Missouri Public Service Commission reducing the maximum charge from 15 cents to 13 cents a kilowatt-hour and the minimum step from 10 cents to 6 cents. The state commission suspended the new schedule after the city protested against the cut rates, charging they were intended to cripple the city's plant. This case is still pending, but will be dismissed since the company is quitting Salem and leaving the city in possession.

A suit brought in the Dent County Circuit Court attacking the legal power of the city to enter into a contract for the purchase of equipment for the power plant on the installment plan, to be paid for out of earnings of the plant, is to be pushed to the Missouri Supreme Court, attorneys for the company state, notwithstanding an adverse decision from that tribunal in a similar case affecting another town.

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New Hampshire Starts Investigation of Rates

NEW HAMPSHIRE has joined the ranks of rate-investigating states. Its Public Service Commission has employed Samuel H. Mildram, a Boston engineer, to make an inquiry. Mr. Mildram has begun on the electric utilities, but the scope of his investigation may be extended later, he says.

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Diesel-Engine Plants for Wisconsin Cities

MENASHA, Wis., is considering the installation of a municipal Diesel-engine generating plant, as are several smaller places in the same state such as Kewaunee and New Gearus. Elroy has already voted for such a purchase, and the Fairbanks-Morse company is said to be conducting a vigorous campaign throughout the state for its method of selling engines on the installment plan, the payments to be met from profits.

Kewaunee residents who disapprove of the plan have begun litigation to prevent the city administration from carrying through a contract of this nature, entered into when the contract with the Wisconsin Public Service Corporation for purchasing power expired.

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Mechanical Resuscitation Not Favored by N. E. L. A.

UNANIMOUS indorsement of a resolution on resuscitation adopted by the accident prevention committee of the N.E.L.A. was granted by the executive committee of the Engineering National Section at its meeting in Chicago a few weeks ago. Premising that a moment's delay in getting to work on a person unconscious from electric shock may mean the difference between life and death, the resolution continues:

On account of the delay in application by apparatus as well as other reasons, the accident prevention committee of the N.E.L.A. goes on record as disapproving the use of mechanical devices to perform resuscitation in cases of electrical shock, and, in the light of the advice given by the various resuscitation commissions and of field experience, reaffirms its absolute faith in the application of the Schafer prone-pressure method by manual means.

Coming Meetings

American Welding Society—New York, April 23-25. M. M. Kelly, 29 West 39th St., New York.

Great Lakes Division, N.E.L.A.—Engineering Section, Detroit-Leland Hotel, Detroit, April 23-25. T. C. Polk, 140 South Dearborn St., Chicago.

Middle West Division, N.E.L.A.—Fort Des Moines Hotel, Des Moines, Iowa, April 23-25. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

Empire State Gas and Electric Association—Accounting Section, Briarcliff Manor, N. Y., April 24 and 25. C. H. B. Chapin, Grand Central Terminal, New York.

Rocky Mountain Division, N.E.L.A.—Conference, Denver, April 24 and 25. O. A. Weller, Public Service Co. of Colorado, Denver.

Missouri Association of Public Utilities—Springfield, Mo., May 1-3. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Division, N.E.L.A.—Hot Springs, Ark., May 6-9. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

American Institute of Electrical Engineers—District meeting, Springfield, Mass., May 7-10; summer convention, Toronto, June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., May 18-23. E. H. Hubert, 420 Lexington Avenue, New York.

East Central Division, N.E.L.A.—Hotel Statler, Cleveland, May 20-23. D. L. Gaskill, Greenville, Ohio.

National Electrical Credit Association—Hotel William Penn, Pittsburgh, May 22 and 23. F. P. Vose, 140 South Dearborn St., Chicago.

National Electrical Wholesalers' Association—Hot Springs, Va., May 26-30. E. Donald Tolles, 165 Broadway, New York.

American Electrochemical Society—St. Louis, May 29-31. C. G. Fink, Columbia University, New York.

North Central Division, N.E.L.A.—Managerial Section, Alex. Johnson Hotel, Rapid City, S. D., June 11-12. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Canadian Electrical Association—Manor Richelieu, Murray Bay, Que., June 11-13. H. M. Lyster, 405 Power Bldg., Montreal.

Pacific Coast Division, N.E.L.A.—San Francisco, June 16. S. H. Taylor, 447 Sutter St., San Francisco.

National Electric Light Association—San Francisco, June 16-20. A. J. Marshall, 420 Lexington Avenue, New York.

Wisconsin Utilities Association—Accounting Section, Eau Claire, June 19 and 20; Electric Section, Lorain Hotel, Madison, July 17 and 18. J. N. Cadby, 105 Wells St., Milwaukee.

American Electric Railway Association—San Francisco, June 21-26. Guy C. Hecker, 292 Madison Ave., New York.

American Society for Testing Materials—Haddon Hall, Atlantic City, N. J. June 23-27. C. L. Warwick, 1315 Spruce St., Philadelphia.

Association of Electragists International—Hotel Schroeder, Milwaukee, August 18-20. L. W. Davis, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.

Commission Bars Sale of Stock to "Foreign" Utility

ACQUISITION of public utility properties in New York State by public utilities of other states has, by inference, been forbidden by the Public Service Commission of New York in denying the petition of the New Jersey Power & Light Company to acquire the entire issue of 172,725 shares of common stock of the Staten Island Edison Company. Both companies are controlled by the Associated Gas & Electric System.

The commission found that the petitioner is not an electric and gas corporation as defined in the Public Service Commission law of New York, which it held to mean a corporation formed under the laws of New York. The commission found also that the words "or foreign" in the Public Service Commission law apply only to such a foreign corporation as would be termed a business corporation under the laws of New York and, therefore, that the petitioner could not acquire more than 10 per cent of the capital stock of the Staten Island Edison Corporation.

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New England P.S. Company to Have Floating Plant

SALE of the 4,743-ton steamship *Jacona* to the New England Public Service Company of Augusta, Me., on condition that the ship within a year be converted into a floating power plant to serve Maine and New Hampshire coast cities was announced at Washington recently by the Shipping Board. The vessel will be equipped with two 10,000-kw. steam turbo-generators of the oil-burning type and four high-pressure water-tube boilers. Power, it is said, will be transmitted to cities for newly established industries where land power facilities are not available. The *Jacona* had been out of commission for eight years. She was sold for $25,000 cash, and the total cost of converting her is put at $1,000,000.

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Des Moines Will Play Ball by Electric Light

FOOTBALL games by electric light are an old story. Professional baseball games are different. The Louisville club was probably the first to take up the idea seriously, which it did last year, being, however, deterred from going ahead with it largely because of financial stringency caused by two unremunerative seasons. It has remained for Iowa to take the lead in actual experiment.

The Des Moines team of the Western Baseball League expects to play all its weekday games in 1930 on a diamond flooded by 146 General Electric floodlamps on top of six 90-ft. towers. The same company's plan for an exhibition game at Lynn, Mass., in 1927 is shown here. The opening floodlight game at Des Moines will be played on May 6.

Dr. Bauer to Act for Georgia Rate Association

ESTABLISHMENT in Atlanta of permanent headquarters in the Chamber of Commerce Building for the Municipal Utilities Rate Association of Georgia has been announced by W. M. Lester of Augusta, president of the organization. Simultaneously comes the statement that Dr. John J. Bauer of New York has accepted the appointment of rate expert for the organization and will spend considerable time in Atlanta. Atlanta, Augusta, Macon, Columbus, Albany, Thomasville, Valdosta, Quitman, Monroe, Waycross, Americus, Newnan, Statesboro and Barnesville, have enrolled.

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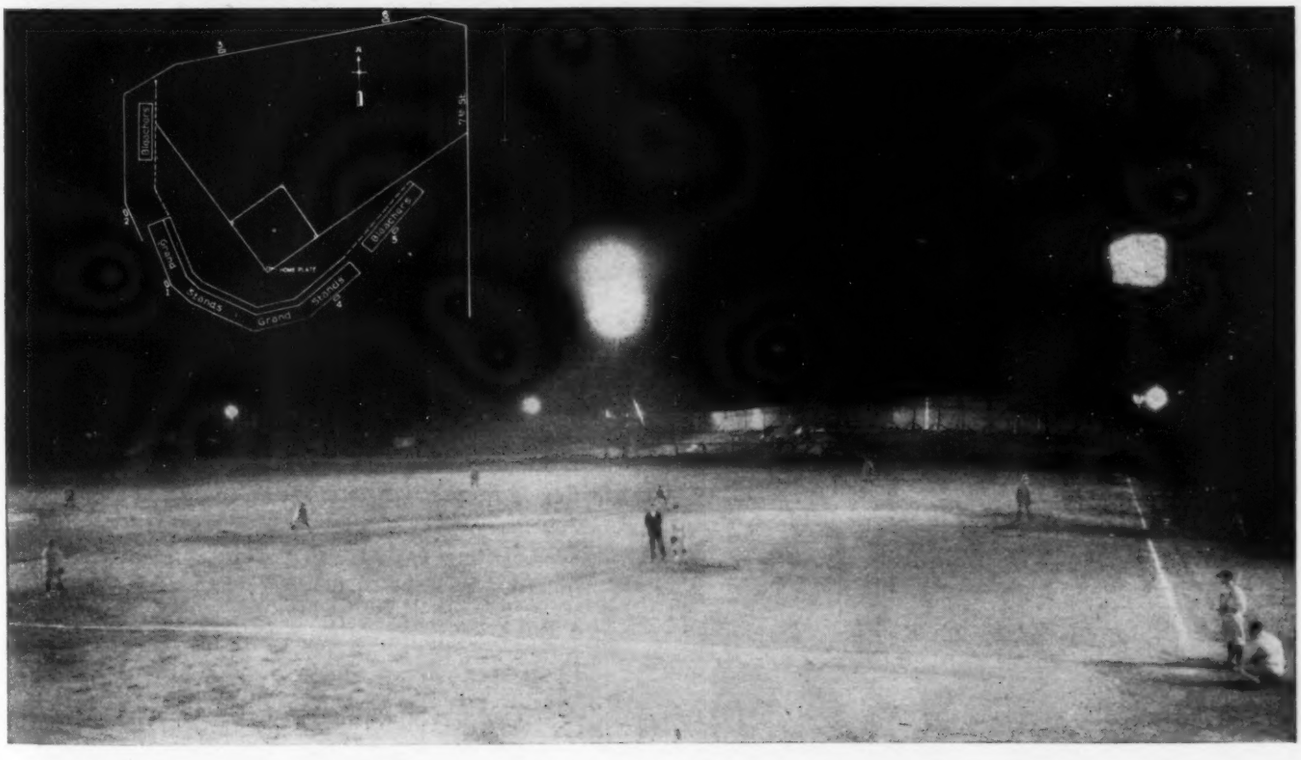
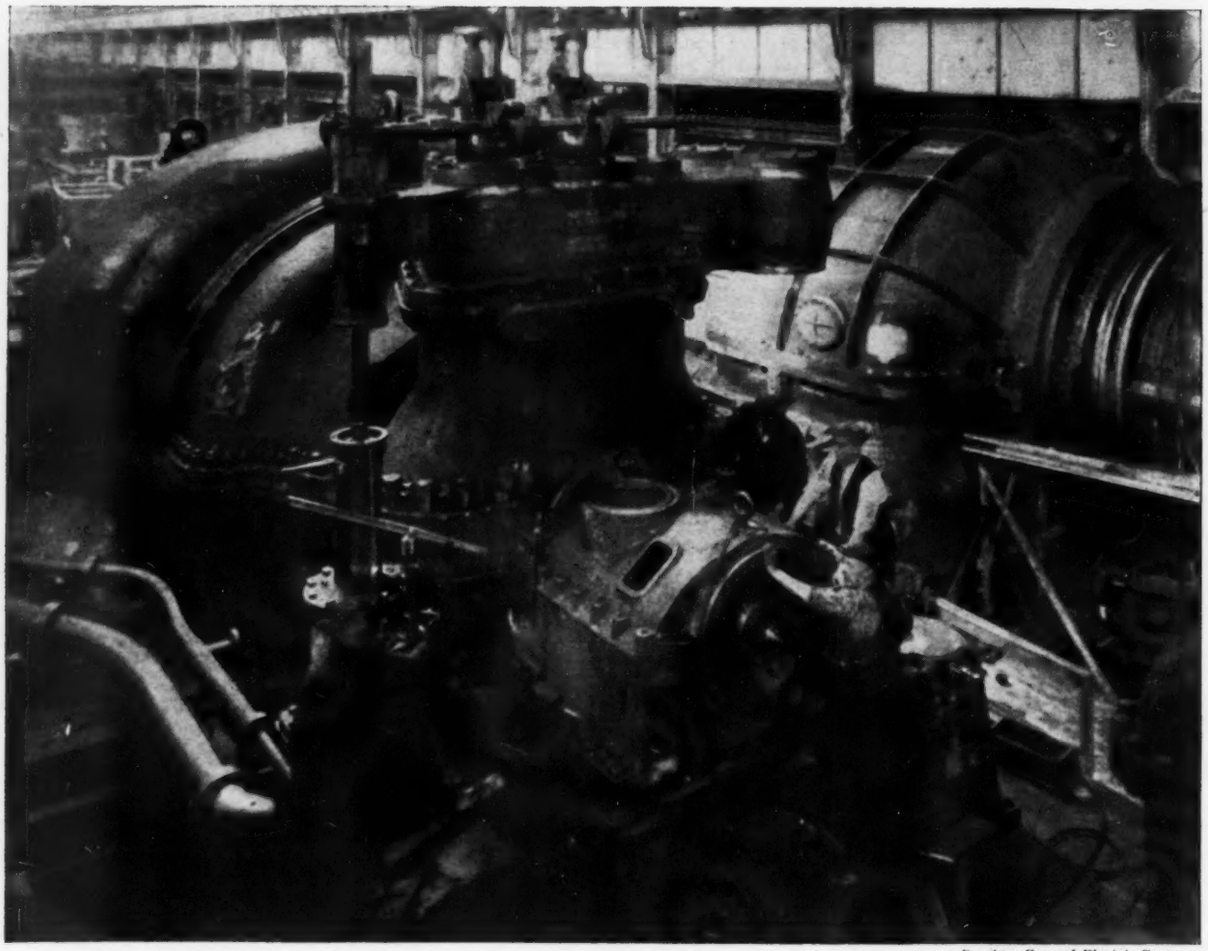
Rocky Mountain Utility Association Proposed

WHEN the Rocky Mountain Division of the National Electric Light Association meets at Denver on April 24-25 it will take up as the most important item in its program the proposed union of the three utility associations of Colorado, New Mexico and Wyoming as the Rocky Mountain Utilities Association. An organization committee has been drafting a constitution for the suggested tri-state amalgamation and will incorporate any recommendations made at the N.E.L.A. executive session.





Courtesy General Electric Company

235,000-Kw. Steam Power for Niagara River

CARRYING coals to Newcastle—water to the well—these two 80,000- and 75,000-kw. generators, and a third for later completion, will add 235,000 kw. to the steam power generated within a short distance of Niagara Falls.

The Charles R. Huntley station addition, for the housing of these units, is now under construction. The larger units are for 60-cycle, 425-lb. gage, 296-deg. superheat, the smaller for 25-cycle, 250-lb. gage, 250-deg. superheat. The 80,000-kw., 1,800-r.p.m., single-cylinder machine is said to be of record size for those specifications.

EDITORIALS

L.W.W. MORROW
Editor

Conflicting Views of Regulation

THE college professor, the lawyer, the utility executive and the editor discussed utility regulation at three sessions of the Academy of Political Science in New York last week. Every shade of opinion was expressed by a group representing active participants in the recent widespread investigation and discussion about public control of power. No new thought was expressed, only the usual and well-known range of conflicting views being exhibited. The symposium started nowhere and ended nowhere—a logical and inevitable result when opinions form the foundations for discussions.

Regulation is in the same category as metaphysics and philosophy as regards facts, in the minds of those who discuss it from the standpoint of politics and psychology. There is no apparent reason based on facts for the wave of discussion and investigation to which allusion has just been made. But this conclusion does not obscure the fact that a very widespread discussion and criticism of present practices in utility regulation prevails. This discussion and investigation is good for the cause. If regulation is sound, it will not be affected; if unsound in some respects, it will be improved. Symposiums made up of thoughtful contributions receive public attention.

No doubt should exist that in the normal course of events opinionated expressions on regulation will give way to logical conclusions based on facts or that regulation will reap the benefits of a national educational campaign whereby the public will understand what it is and how it works. The facts will come to the front in time and will lead to conclusions that will make regulation impregnable to political influences or attacks. The New York symposium reported in this issue of the ELECTRICAL WORLD is a start in the right direction. Although inconclusive, it is constructive and should be followed by others. Thoughts put on record can be checked against facts.

Face-to-Face Telephony Dashes Another Barrier

ANOTHER enveloping stride by the ubiquitous telephone! Last week the first demonstration of commercially practicable two-way television telephony was made under the auspices of the American Telephone & Telegraph Company. From the ease of a well-upholstered chair and in the placid comfort of a restful blue light, sans visible telephone instrument, sans loud speaker and sans distracting mechanical insistencies, one may now converse and see simultaneously. The results obtained are amazing, for, though not perfect in the sense of utter flawlessness, there is little indeed about which to be captious in this latest telephone development. Clear, fully recognizable, distinct transmission of speakers' images has been attained.

Today's development requires large quantities of apparatus, the equivalent of thirty circuits in station facilities, and is only available from two established points, separated by possibly a mile and a half—but how it will appeal to the imagination of the public! Transatlantic telephony got away to a far from imposing start only to become a highly dependable business necessity for those who are willing to pay the necessarily high charges. Two-way television telephony may become no less. What price would be too great upon occasion? Business calls between strangers would

lose that impersonal curtness that even the voice with the smile can dispel only with difficulty. The day when we shall all have "no more privacy than a goldfish" is coming rapidly nearer.

Reassured by Science

IN THE opinion of Dr. Robert A. Millikan the universe is not disintegrating. The breakdown of matter into energy here on earth is compensated for by an equal formation of matter from energy in interstellar space. This opinion, in contrast to that of Sir James Jeans, is very reassuring to those who have paid heed to the frequently threatened catastrophes developed in post-futurist minds.

Of course, the infinitesimal mite we call the world may be lost in the energy shuffle, and life is not guaranteed on this particular spot in the universe through the re-creation of energy by cosmic radiation. But we pride ourselves on our breadth of view and shall unselfishly think, not of ourselves, but of other worlds that bedeck the heavens. We also have a feeling of security in that our present world will last comfortably for another 200×10^6 years more or less. The wonder of science is that it liberates our minds from the trammels of our environment and enables us to vision a universe through the exercise of profound thought.

Getting More Capacity Out of Old Machines

BETTER and better use of materials has been accomplished by engineers in late years, as evidenced by the larger motor and generator outputs obtainable in the same space and with the same weights of material as older units of smaller ratings.

Just recently a 5,000-hp. motor, twelve years old, was rebuilt to develop 8,000 hp. While the speed was increased from 40 r.p.m. to 50 r.p.m., the major increase in rating was obtained by applications of advanced design. In another case a 3,600-hp. motor, thirteen years old, was rebuilt for an output of 6,000 hp. without any increase in speed. The rebuilding was done in one week by working overtime. By rebuilding the stator of a 32,500-kva., 25-cycle generator it was possible to reduce the continuous losses 242 kw., thereby producing an annual saving of $10,000. This unit had been subjected to a coil fire which required the rebuilding of the stator.

Other examples might be given, but those cited are sufficient to indicate the magnitudes of increased output and reduced losses possible through rehabilitation of large old machines. Usually the benefits obtained will more than offset the cost of the change.

Use of Advertising by the Power Industry

A GREAT many dollars are wasted in advertising because men overlook one very simple truth in human relations. It is this fact—that people are interested primarily in themselves. And so they write and publish messages addressed to the public that discuss, not the affairs of those individuals who form the public, but the interests of the advertiser himself. Quite naturally, the public refuses to be bothered and turns away. The money and the effort and the opportunity have been sacrificed largely in vain. Such has been the fate of a great deal of so-called "good-will" advertising that has been done by the power industry at various times in the last twenty years. For it has talked not about the personal interest of the householder or the business man in the service which the utility renders him, but about those activities, achievements and characteristics of the utility company of which it is itself proud. The pride may be entirely justified. But to the public it does not make important or interesting reading.

The most successful national advertisers have discovered the key to the public interest and displayed it well with infinite diversity of detail. This secret is simplicity itself. They speak always from the viewpoint of the customer. They point out in intimate concern how the service or the commodity they desire to sell will bring enjoyment, comfort or some other benefit to the reader. They vary the approach. They alter the style.

They disguise the appeal. They garnish the message with all the artistry of form and color. But the method remains always the same. They play continually upon the magic chord of self-interest, for here naturally and properly lies the universal appeal.

The power industry is fortunate in that the service it sells stands so intimately related to all men. It provides essential light, heat and labor-saving power for daily use in every modern home. It brings a kind of practical benefit to every office, store and factory that is vital to production and to prosperity. These are the intimate concerns that men are interested in. These are the things that power-company advertising should talk about. It should continually focus upon these themes that perpetually concern the customer—and this is hard to do. It is hard to do because the executive who must approve the advertising copy is apt to be so absorbed in the affairs and aspirations of his organization that his perspective on the art of advertising is distorted. Institutional and so-called good-will advertising is often more appealing to him, and he forgets that this is a purely secondary and supporting influence to be used with definite purpose and with restraint.

We are now in the era of market development in the power industry. Advertising is a vital factor in sales. There is no more important commercial consideration before the utility today than the intelligent use of this highly specialized branch of selling.

Tolerances and Motor Drives

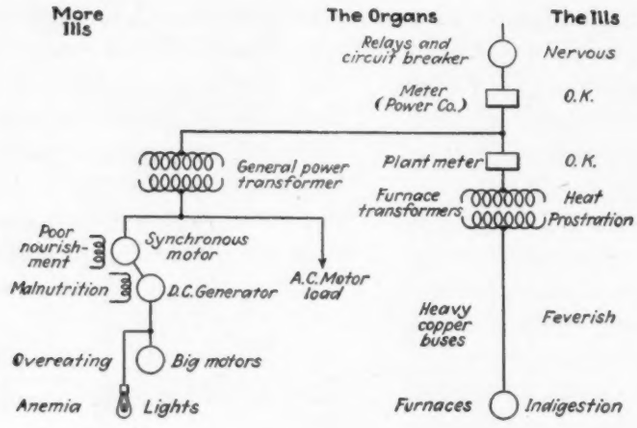
CURRENT experimental developments in direct-current variable-speed motor applications to main spindles of important machine tools are likely to be worth watching.

Tolerances specified in motor-car manufacture are now so small that the machine tools required for such work may truthfully be classed as instruments of precision. These run in a well-known make from an average of one-half a thousandth of an inch to a minimum of one ten-thousandth. To attain and maintain this accuracy the resources of the mechanical engineer are severely taxed, and the problem of overcoming the irregularities of line and surface resulting from the effect of complex gear wear, backlash and "chatter" on the smoothness of cuts brings one to the consideration of the possibilities of direct motor application. These irregularities may be invisible except under the microscope, but they may become cumulative in the assembly of separate interchangeable parts and require excess time and labor in fitting, with corresponding delays in the movement of material along the path of shop routine.

Research Leaders Guide Engineering Education

THE recent election of Dr. Karl Taylor Compton to the presidency and of President Samuel W. Stratton to the chairmanship of the board of the Massachusetts Institute of Technology places two men of high distinction in scientific research at the head of what might fairly be designated a great engineering university. In view of the pressure of administrative duties which must be sustained by educational executives under present-day conditions, the question arises in some minds: "To what extent can exceptional talents for research be utilized in the guidance of engineering education? Is there danger that in putting abilities of this valuable kind at work in directing the daily routine of such an institution and planning for its development and maintenance creative science will suffer?"

One cannot assert that by transferring a scientist from a laboratory table to an office desk research as a whole will lose in creative achievement, although the change may result in intermittent instead of continuous contact with specific lines of inquiry. A basic understanding of applied science is vital to the successful administration of any institution whose functioning rests upon profound technical considerations. Engineering education and the research associated with it are not affairs to be administered by untrained leadership of the "office manager" or "business executive type" so highly reverenced by the man in the street. Therefore, if to talent for research be added executive ability, we have a combination admirably suited to the successful administration of a highly technical institution or enterprise, assuming that a regular seat at the table is also given to economic insight.



Except for these ailments this industrial plant was vigorous and healthy

How an Industrial Plant Cured Electrical Ills

THE phenomenal electrification of industry has not always been accomplished painlessly. The electrical equipment and system have their occasional ills and idiosyncrasies; indigestion may be the consequence of improper assimilation of the electrical diet by the mechanical patient. Under such conditions the specialist is summoned for consultation or the plant doctor takes charge in his own right. Once in a while the consultant or the practitioner can be persuaded to talk freely, and then you elicit a chain of episodes that are not always less fanciful than the "true story" in the following narrative:

Once upon a time there was an industrial establishment which enjoyed melting a certain metal and then finishing the shapeless lumps into useful products. The product was the thing and the preliminary processes were regarded as necessary evils, tolerated but not encouraged. Even space was grudgingly granted for these processes. Space that should have been assigned the apparatus was reserved for some vague, intangible purpose that might turn out to be mere truck lanes or storage of goods in intermissions between processing. No amount of pleading on the part of the seller and installer of the transformer-bus-furnace outfit swerved the management from its unholy purpose of granting only space not otherwise useful some day. There was no disposition on the part of the management, however, to depart one tittle from the performance guaranteed; guaranteed, of course, on the assumption that the opportunity to prove itself would at least be half-way conciliatory. Well, there followed a few months of operation.

Then the critical attitude asserted itself and comparisons of results were made with what were thought to be comparable cases elsewhere in industry. The result was a shock. The doctor was called. He quickly found that the patient was not getting less calories than the utility grocer was charging for; the light and power company's meter was correct. Next he found that all the food was being weighed on the customer's own scales. These, too, were found to be correct, making due allowance for shrinkage between the street and the kitchen; the line from the metering entrance point to the transformer vault was not introducing inordinate losses. But there still seemed to be much wrong. The chart shows the ailments ultimately disclosed in different parts of the organism.

Transformers and buses feverish

In the first place the patient was running quite a fever. This fever was principally the result of inadequate ventilation of the transformer vault. The transformer losses were high and the temperature dangerously near the failure point. All it required was a husky fan to fix that difficulty. Another contribution to the high temperature and losses in the vault came from the buses. Apparently no great pains had been taken to make the best joints possible and, worse, the clamps which encircled the buses were of iron, accentuating the eddy-current losses.

The saddest thing was, however, the fact that the transformers had been located (at the insistence of the factory owners) about three times as far from the furnaces as was at all necessary. The doctor proved his point and won support for his recommendation of a major operation. The savings would justify the cost of moving the transformer vault to a location directly below the furnaces, in space that could just as well have

Shortsighted policy in electric furnace installation leads to reduced efficiency. Plant operators occasion serious power interruptions by uninformed manipulation of equipment

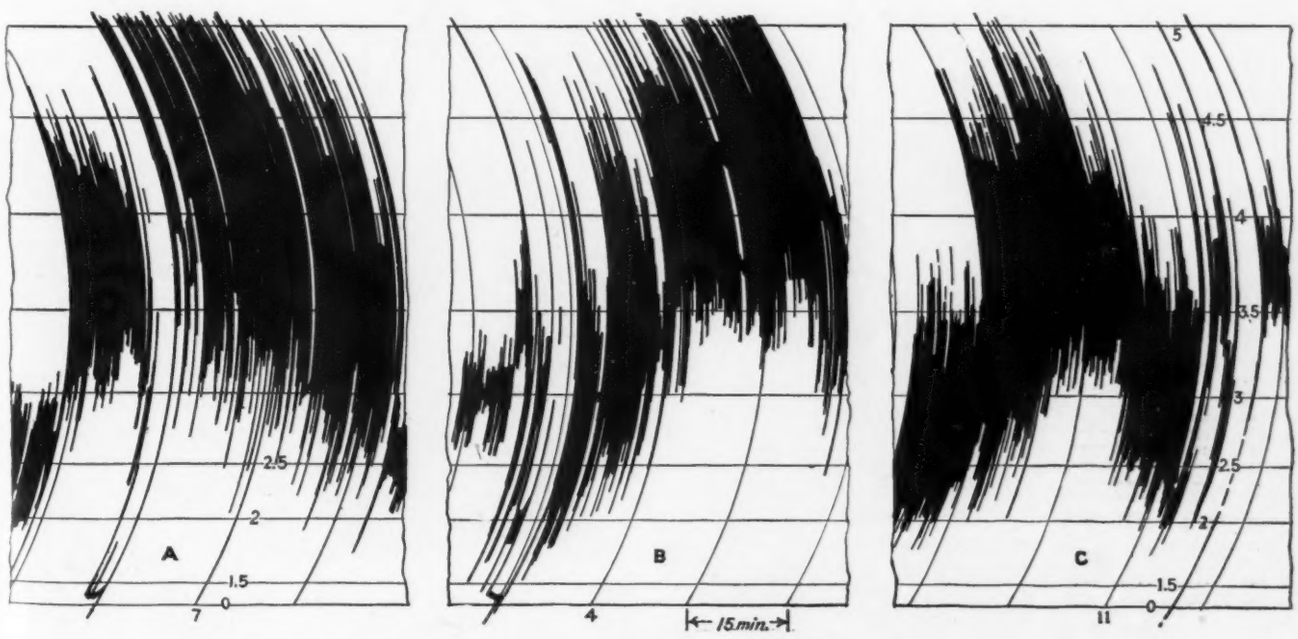
been utilized in the first place. It cost several thousand dollars to do it, but the installation was soon to be tripled anyway, so this extra was swallowed up in the expansion budget and did not hurt so very much. The copper bus material reclaimed helped considerably, even though some of it was used to increase the slightly inadequate cross-section of the original buses. These moves succeeded in cutting the bus losses to one-third their previous distressing total.

The ventilation of the vault had brought the transformer efficiency reasonably near the guaranteed value. But the over-all losses on bus and transformers were still above the values hoped for at the outset. One glance at the load curves ought to be explanation enough. It seems that the metal did funny things to the arc in the furnace and made the arc current fluctuate violently. Any electrically informed person will know that high losses are to be expected under such conditions. If the current is double value for half the time and nothing for the other half, just to assume an illustration (not, however, too far from the facts), the losses are double what would result from steady load of half the maximum fluctuating value. The plant folks were told they would have to call a metallurgical practitioner if they wanted the arc to behave.

One other incident arose during the planning for the revamped and enlarged installation. The wiring contractor wanted to inclose the shortened bus leads in a large brass pipe; he proposed brass because he had overheard that iron would not be good for the same reason that iron bus clamps were detrimental in this particular case. The specialist prevailed, however, and the buses were inclosed in an insulating material supported in a minimum of metallic framing.

The enlarged and revamped furnace outfit then worked to the moderate satisfaction of the plant proprietors, as far as kilowatt-hours per ton were concerned, but new troubles suddenly developed. A second inspection of the load curves will reveal something probably missed on the first glance. There are three complete interruptions appearing in the fragments of load curve as selected for the diagram, each right in the midst of a melt. These were not merely an interruption of the arc; they signify a *shutdown of the whole plant*. The records were interpreted by the consultant when he was frantically called after the interruptions over several days had become more frequent, more persistent, more mysterious and of longer duration. Of course, "it is a serious thing to interfere with the productive zeal of several hundred employees just because some fancy furnace goes off on a cranky tangent." At least that was the way the excited management put it. It does not take more than one or two such interruptions per week to obliterate all the savings accruing from the previous progress toward efficient functioning of the furnace installation.

Maybe the relays on the utility's feeder were set too close. No, but the load was momentarily much in excess of the cable capacity. The plant had overlooked the little courtesy of letting the power company know that the demand had been increased. The power company immediately started the installation of additional cable capacity. Maybe the intermittently operated furnaces unbalanced the load badly on their respective phases. Yes, they did, so the transformers were reconnected and provision made for switching to balance



Special metal makes furnace load fluctuate. Interruptions result from causes originating elsewhere in the plant

the load when an irregular, curtailed or accelerated production disturbed the preconceived balance.

Assurance had been given all this time that there could be nothing wrong in the machine tool part of the establishment, which merely comprised motors and such. The consultant, however, was not persuaded and he waxed inquisitive. The clues made two items in the plant look decidedly suspicionable, if not culpable. One of these was a husky motor driving a machine which did the rough tooling on the heaviest pieces made in the plant. The operator was on piece work and figured the quicker he got the machine up to speed on each operation the fatter his pay envelope would be. He therefore hustled the handle of the drum controller around to the stop. It seemed to be largely a case of the daisy saying to the relays, "One I love, two I love."

Furnaces were not the real cause

But the relays were not tripping because of this machine tender's eagerness alone. There were other links in the mystery.

Plenty of the industrial plants have honest need for direct current for adjustable-speed motors and equally discriminating purposes and this plant was no exception. The d.c. supply was derived from a motor-generator set in which the motor was a synchronous unit. The generator supplied the lights as well as the special d.c. requirements, including the motor in the hands of the industrious shop-hand mentioned. The plant engineer had been annoyed by the outages and had arrived at the conclusion that he might sooner or later be quizzed about them, so he conceived the idea of reducing the excitation and voltage on his d.c. generator. The lights suffered but—and that is another whole story; they were already woefully inadequate. The reduced voltage just egged the machine operator on to greater endeavor and the outages were not abated.

Reduced excitation poor remedy

The plant engineer next reasoned this way. If less excitation on the direct-current generator offered any chance of alleviation of the difficulty, why not try reducing the field current of the synchronous motor? He dimly remembered that some one had told him that there was one best reading for the armature-current ammeter in the motor line. Lo and behold, there were two settings of his field rheostat which would produce this result, and naturally he chose the one involving the lesser field current. He was quite unconscious of the fact that one would result in leading power factor functioning of the motor and the other in lagging power factor. He was equally unaware of the inferior excess-torque capacity of the motor under lagging power factor conditions.

In short, what was happening was this: The heavy starting current taken by the rapidly accelerated motor in the shop created a sudden increase in load on the d.c. generator. The synchronous motor tried to meet the requirements imposed on it, but was handicapped by the reduced field excitation on it. It was forced into a pull-out. The surges of current to it in this period, piled on top of the current taken at the moment by the erratic and unbalanced furnace load, tripped the relays in the main supply and everything stopped.

A push-button, automatic, predetermined-acceleration controller was recommended for the big motor, the d.c. generator voltage was brought back to normal, the synchronous motor excitation was corrected and, along with the rebalancing of the furnace load, these remedies terminated the vexatious interruptions.

The patient recovers

The recital cannot, of course, end without the customary finis to the effect that "they lived happily ever after." Nor can the temptation to moralize be wholly eradicated. Should the plant executives have known better than to expect the impossible of the transformers, buses and furnaces, or should they have acquired competent advice, either temporarily or permanently? Should the operating engineer have known better, or should there have been some one to tell him better? Should the machine operator have known better, or should he have been furnished with equipment that he could not in his zeal circumvent? Repressive ethics forbid the consultant and the practitioner from answering these queries and the writer has no desire to tread where angels are overcautious.

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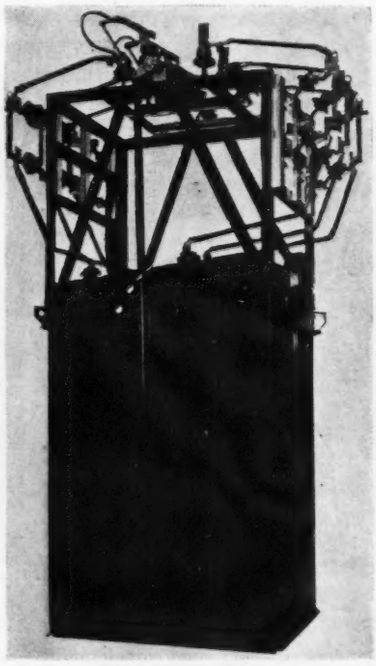
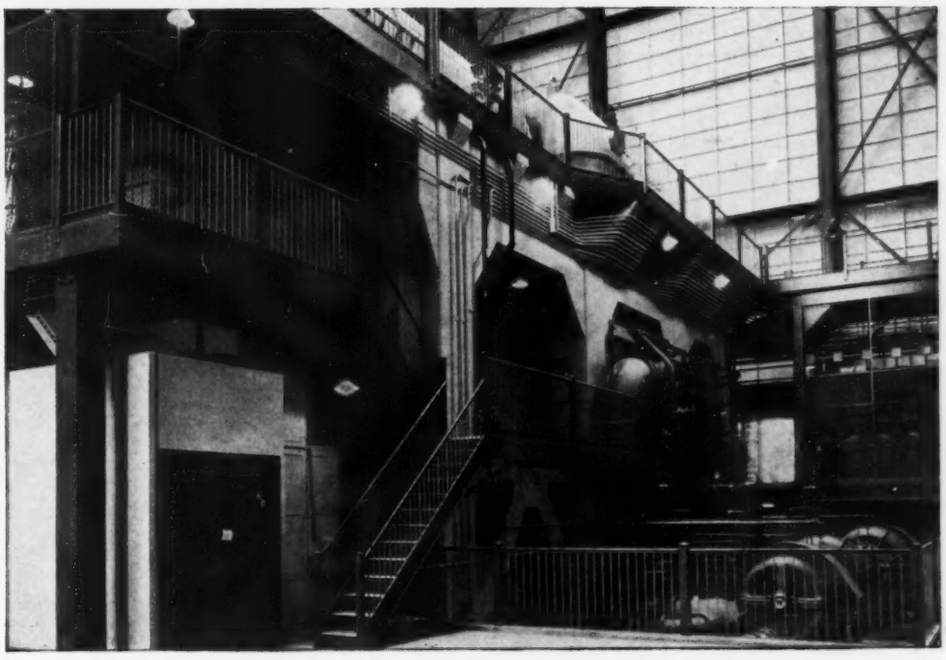
An Inexpensive Suburban Substation

By R. G. DAILY
Switchgear Department,
Westinghouse Electric & Manufacturing Company



A NUMBER of outdoor switchhouses have recently been supplied to the Florida Public Service Company which consist of a standard switchhouse unit equipped with an open superstructure for mounting outdoor disconnecting switches. Three single-pole, single-throw switches are mounted on each of two sides of the superstructure for disconnecting the switchhouse from the incoming and outgoing lines. A three-pole, single-throw, gang-operated disconnecting switch is mounted on top of the superstructure for bypassing the power when the isolating switches have been opened. The whole constitutes a simplified outdoor substation at minimum cost. Installation time and expense are reduced, shipment being made completely assembled ready for connection to the lines.



Steel and reinforced concrete support for 35,000 - kw. turbo - generator. Space underneath is utilized for condenser, pumps, field rheostat, reactors, fire protection, etc.

Standby Permits Instantaneous Load Pick-up

THE requirement that a 35,000-kw. turbo-generator normally be floated on the line as a synchronous condenser and yet be able to pick up full load instantly in case of system trouble imposed problems of design on the Great Western Power Company's new steam standby plant in San Francisco. Liberal boiler capacity, extra large steam and hot water storage facilities, an arrangement to bypass steam into the second stage of the turbine and many automatic features in connection with the auxiliaries and house turbine make this possible.

One of the first considerations in the design of the plant was to be able to carry full load on the turbine with a maximum drop in steam pressure from 430 lb. to 235 lb. upon sudden application of load on the generator. Under normal standby conditions the generator is operating as a synchronous condenser with about 15,000 lb. of steam per hour passing through the turbine. This is sufficient to keep the turbine from overheating and in a condition to pick up full load immediately. Under these conditions the boilers are operating on pilot burners only, maintaining a boiler pressure of 430 lb.

When full load is suddenly imposed on the unit there will be a drop in steam pressure while the boilers are being fired up to the point where the additional steam demand can be supplied without further drop in pressure. Steam pressure at the throttle may drop to as low as 235 lb., at which pressure the first stage will not pass sufficient steam to carry full load. This situation was met by providing a secondary valve which will open after all primary valves have opened and admit sufficient steam to the second stage to develop 35,000 kw. at 235 lb.

For standby operation the governor synchronizing nut is set to permit the machine to carry 35,000 kw. at 0.8 power factor and 60 cycles as a generator. An adjustable tie rod blocks the governor against picking up load by holding the governor beam down to the no-load normal frequency position. This tie rod is equipped with an adjustable ball-and-socket connection which breaks apart at a drop in frequency of from 0.6 to 1 cycle, allowing the governor to assume control of the turbine. Within two seconds after the governor takes control the admission valves will pass the amount of steam required to carry a load of 35,000 kw.

The oil feed to the header supplying the main burners is closed by a solenoid-operated valve when the plant is standing by, leaving the furnaces operating on pilot burners. The forced draft fans are shut down and the induced draft fans and circulating water pumps are operating at reduced speed. When a sudden load is thrown on the plant by a system disturbance, either a drop in steam pressure or the operating of a switch actuated by the house turbine throttle-valve mechanism sets in operation a motor-driven drum controller. This controller opens the main fuel valve, giving the boilers full fire, and brings the required auxiliaries into operation at full speed in the proper sequence, all in about 30 seconds.

The house turbine also normally operates as a synchronous condenser, power being supplied to the auxiliary bus from the system through a bank of 11/2.3-kv. transformers. Any small drop in frequency which causes the main unit to pick up load also causes the house generator to cut loose from the system by the

SOME OF THE MAJOR EQUIPMENT FOR QUICK-STARTING UNIT

Main generator (General Electric), 43,750 kva., 11.5 kv., 60 cycle, 1,800 r.p.m.; 35,000 kva. capacity as synchronous condenser at zero power factor, overexcited.

House generator (General Electric), 2,500 kva., 2.3 kv., 60 cycle; 2,000 kva. capacity as synchronous condenser at zero power factor, overexcited.

Main turbine (General Electric), 43,750 kw.; 43,750 kw. max. capacity at 350 lb., 625 deg. F., and 35,000 kw. max. at 235-lb. dry, saturated steam.

House turbine (General Electric), 2,500 kw.; 3,000 kw. max. emergency capacity with 235-lb. dry, saturated steam and 3-lb. gage back pressure. Normal operation 2,500 kw. at 350-lb., 625-deg. F. steam and 1-lb. gage back pressure.

Exciters (Allis-Chalmers), 200 kw., 250 volt. Driven by 300-hp., 2.3-kv. Allis-Chalmers motors, one dual with 300-hp. Terry turbine.

Boilers (Hedges-Walsh-Weidner), 2,250 hp., 290,000 lb. per hour. Cross-drum, straight-tube.

Purifiers (Hagan), two on auxiliary drum each boiler.

Superheaters (Foster-Wheeler), 9,280 sq.ft. Overdeck, double-loop convection.

Air-cooled walls (Deitrich) 2,000 sq.ft. Sectionally supported with 9-in. tile and 9-in. air space backed up by 1.5-in. insulated steel casing.

Fuel oil storage tank (Western Pipe & Steel), 37,500 bbl. One now, one future.

Fuel oil pumps (Quimby), 25 gal. per minute, driven by a 15-hp. Terry turbine; 140 gal. per minute, driven by 50-hp., 2.3-kv. Westinghouse constant-speed induction motors.

Fuel oil heaters (Griscom-Russell), 68,000 lb. per hour. Tagliabue temperature controllers and valves.

Burners (Peabody), 225 to 1,500 lb. per hour main burners, 50 to 300 lb. per hour pilot burners.

Forced-draft fans (American Blower), 65,000 cu.ft. per minute at 160 deg. F., 6-in. static pressure. Single-inlet, radial-flow; forward curved-blades; driven in pairs by 250-hp. Westinghouse 2.3-kv. constant-speed motors.

Induced-draft fans (Sturtevant), 60,000 cu.ft. per minute at 500 deg. F., 135 r.p.m., 0.35-in. static pressure when driven by special 10-hp. Westinghouse motor through Texrope drive (light loads); 250,000 cu.ft. per minute at 725 deg. F., 490 r.p.m., 3.6-in. static pressure when driven by 275-hp., 2.3-kv., Westinghouse motor.

Boiler feed pumps (Cameron), six-stage, 1,000 gal. per minute at 525 lb. One driven by 2.3-kv. constant-speed Westinghouse motor; one driven by Terry turbine, atmospheric exhaust (spare unit).

Condenser (Ingersoll-Rand), 27,400 sq.ft. Single-pass, divided water box, rigid connection, spring supported.

Circulating pumps (Ingersoll-Rand), 28,700 gal. per minute, two pumps on entire condenser, 35,000 gal. per minute, one pump on entire condenser. Two-speed, 192 and 315 r.p.m. driven by two-speed 175/50 hp., 2.3-kv. Westinghouse motors.

Condensate pumps (Ingersoll-Rand), 1,150 gal. per minute, 575,000 lb. per hour. Driven by 75-hp., 2.3-kv. constant-speed Westinghouse motors. (One unit spare.)

Air removal equipment (Ingersoll-Rand), 72 lb. per hour. Steam jet with surface type inter- and after-condenser.

Deaerator (Elliott), 500,000 lb. per hour normal, 600,000 max. Re-boiling type with heating and air separating trays.

Extraction heater (Elliott), 365,000 lb. water per hour, 94-164 deg. F. Seventh stage 1,200 sq.ft., 27,300 lb. steam per hour; Admiralty tubes.

Evaporator (Griscom-Russell), 13,500 lb. per hours. Single-effect, high heat level. Evaporator feedwater heater (Elliott), 25,000 lb. per hour. Open type. Combustion control (Carrick).

Fire extinguisher equipment (C-O-Two Fire Equipment Co.)

operation of reverse power relays, picking up the auxiliary load and maintaining constant speed on all motors. Two closely related automatic operations bring this about. The valve gear, operating as a result of frequency drop, releases a latch, causing a mechanism to open the throttle valve wide within 1.5 seconds. As the unit picks up load, reverse power relays cause an oil circuit breaker to isolate the house turbine and the 2.3-kv. station service bus from the 11.5-kv. system.

The house turbine operates non-condensing when carrying load. However, the house turbine is evacuated by means of a bypass connection to the condenser for the main unit, thus reducing power input when it is operating as a synchronous condenser. This makes a reduction from 175 kw. at 1-lb. gage to 125 kw. at 1.5-in. absolute vacuum.

Oversize drums and combustion chambers used to permit quick steaming of boilers

Because of the unusual steam demands imposed upon the boiler plant, certain features not found in the average plant were incorporated. There are two boilers, each rated at 2,225 hp. and capable of evaporating 290,000 lb. of water per hour. Each boiler contains thirteen 4-in. tubes per section in each of its 56 sections. Due to the uncertainty of circulation characteristics of water-cooled walls under such rapid load changes, and because of higher initial cost, air-cooled walls were used. Water-cooled walls may later be installed if desirable.

To meet the requirements of rapid load changes oversize combustion chambers, 21x33x25 ft., were provided. There are 29 burners under each boiler, nine of which are the pilot burners previously mentioned. The main burners have a fuel range of from 225 to 1,500 lb. of oil per hour each, while the pilot burner range is from 50 to 300 lb. per hour. This provides a maximum total short-time fuel-burning capacity of 32,700 lb. per hour with a heat liberation of 34,000 B.t.u. per cubic foot of combustion chamber.

A maximum of steam-generating surface is provided and the possibility of priming is reduced by making the main boiler drums oversize as compared with usual practice. These drums are 40 ft. long and 6 ft. in diameter. Another special feature is the 3x36-ft. auxiliary steam drums for each boiler. Special baffles and purifiers on the two saturated steam outlets which lead to the superheaters are designed to insure separation of water from the steam under heavy steam demands. Normal boiler pressure is 4.. lb. and total steam temperature 625 deg. F. Each of the double-loop overdeck superheaters has a heating surface of 9,280 sq.ft.

The only thing of particular interest from the electrical standpoint is the fact that the output of the plant is fed into the system at generator voltage of 11.5 kv. through an outdoor double-bus switching station.

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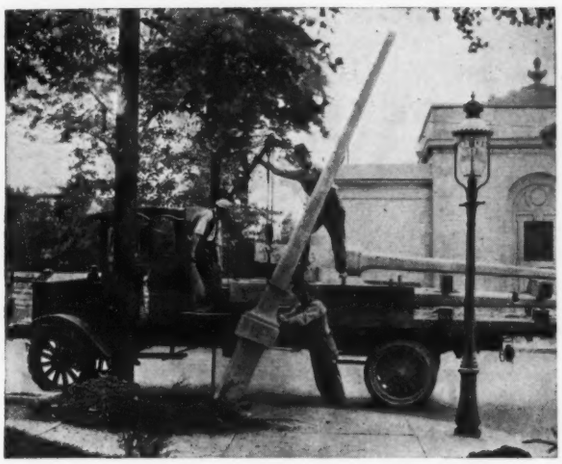
Power Hoist on Trucks Saves Space and Time

By J. W. BROOKS

Superintendent Construction and Maintenance Department of Public Utilities, St. Louis, Mo.

NOTABLE savings in labor and time have been accomplished on different jobs by using power take-off hoists mounted on line trucks. With the power take-off hoist shown two men and a truck chauffeur are able to load concrete standards, thereby saving the time of two other men who would be needed in operating a hand hoist. Such a hoist is also a space saver in com-



Two more men would be needed if a power hoist were not available

parison with a hand hoist, since the latter is usually installed on the bed of a truck and, with the men needed to operate it, occupies the room of at least four concrete standards. For example, in widening Delmar Boulevard it was necessary to reset 34 concrete street lighting standards.

Two linemen and two laborers were sent ahead of the truck, the linemen digging post holes at the new location while the laborers removed the necessary concrete and excavated around the standard to be removed. It was never necessary to remove more than 6 to 8 in. of earth from around the standards. When the truck arrived, a sling was put around the standard about 3 ft. from the base and the hoist attached. The linemen shoved the standard back and forth while the chauffeur, who operated the hoist, raised the standard (weight 1,200 lb.) very easily. When the standard was about 2 ft. above the ground or when the cable slot appeared above the earth the hoist held the standard in position until the linemen removed the cable from the standard; the chauffeur then proceeded with the removal of the standard from its old location and set it in the new posthole dug by the advance linemen.

Conservatively, about 50 per cent saving in time and labor was attained by the use of this hoist.

During the tornado of 1927 it would have been impossible for us to have repaired the damage done to our street-lighting system in the record time achieved without a power take-off hoist. The hoist was not only indispensable in pulling up broken poles and replacing these with new ones, but also in removing roots of large trees to speed up the repair of damaged cable torn up when the trees were partially uprooted in the storm. Power hoists are also convenient in loading cable reels for rapid-run-off.

The lighting division of this department now has four trucks equipped with Mead-Morrison hoists. Two of these trucks have been in service more than five years without serious accident during the hoisting of concrete standards or reels of cable.

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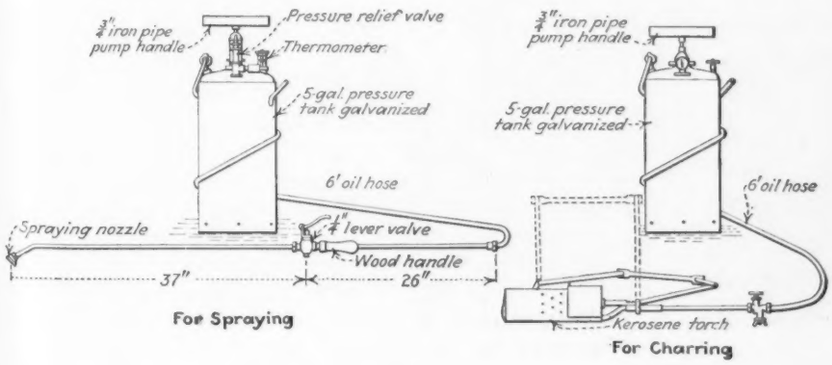
Wood Pole Life Extended Five Years for a Dollar

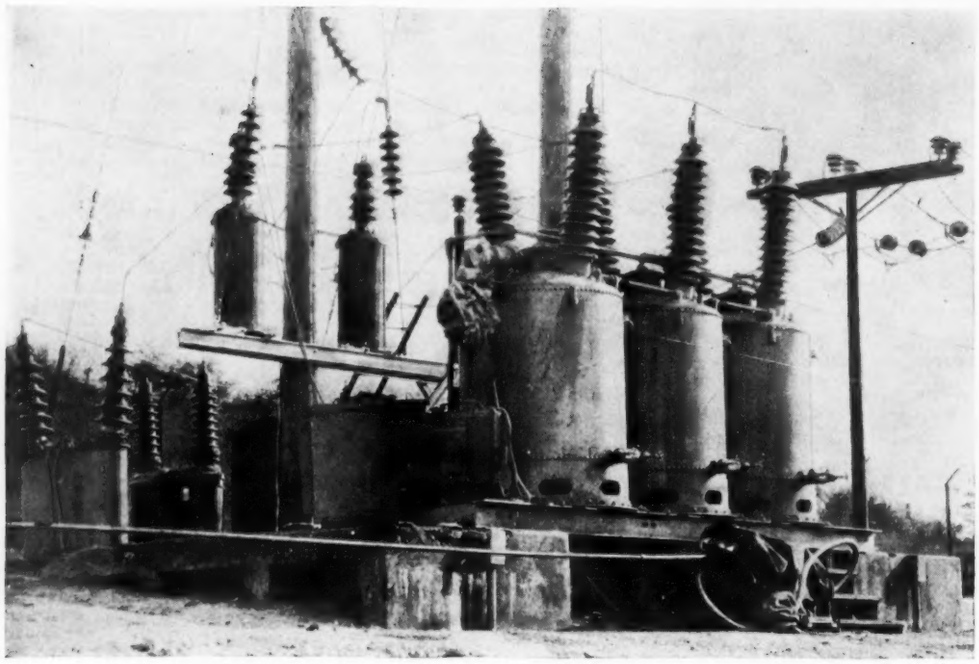
THE use of a charring and spraying process for the protection of wood poles now in place may add at least five years to the life of the pole and cost but 80 cents to $1 per pole, according to H. T. Corcoran, distribution engineer Connecticut Light & Power Company, Waterbury, Conn.

The practice involves removing the earth to a depth of 18 in. below the ground line, scraping the decayed wood from this exposed area of the pole and charring and spraying with wood-preserving oil. Treatment extends from a point approximately 18 in. below the ground line to approximately 18 in. above the ground line. The treatment has been largely developed by the Protexol Corporation of Kenilworth, N. J.

Charring and preservative treatment economically prolongs pole life



Field Tests on Deïon



Set-up for interruption tests on Duquesne Light Company system using "Deïon grid" breaker

THE electric arc is the fundamental problem of circuit interruption. The theory of the arc is still incomplete, but the ionization theory suggested by Dr. Joseph Slepian has enabled physical explanation to be made of the behavior of an oil breaker in terms of ionization of gases.

THIS theory develops principles that may be applied in many ways to the mechanical devices used as circuit interrupters. The Deïon grid breaker was developed as a device based on these principles and this article gives field tests on operating properties at voltages of 66,000, 110,000 and 222,000. The results of the tests show that power circuits can be interrupted in about 8 cycles maximum from the time the trip mechanism is energized.

IN THE past the manufacturer's aim has been to build an oil circuit breaker which would show little distress on interrupting large powers, develop a minimum amount of gas and pressure and throw little or no oil. The present oil circuit breaker operates in extinguishing an arc in oil either by increasing the distance between contacts or by establishing a high pressure and forcing oil into the arc stream. In the first method are found breakers having two arc-drawing contact members, each of which draws an individual arc by movement of a cross-bar on which the contacts are carried and is known as plain break; quick-breaking contacts, in which the initial movement of the cross-bar compresses a spring, which when released separates the contacts at a high speed, and multiple breaks, in which four or more individual arcs in series are drawn. The second method of arc interruption is the explosion-pot breaker and generally is a two-break breaker.

While the principles of arc interruption have not been changed for some time, the oil circuit breaker, taken as a whole, has undergone numerous changes and improvements so that today it is a reliable piece of apparatus. The major improvements have been in operating speeds, use of welded construction, more reliable operating mechanisms, stronger mechanical parts and many other details which all go to make up a satisfactory oil circuit breaker.

As a result of a systematic study of arc interruption, both in oil and air, a new device in switching equipment has been developed and a more comprehensive under-

Grid Breakers

By L. W. DYER

Circuit Breaker Engineering Department,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

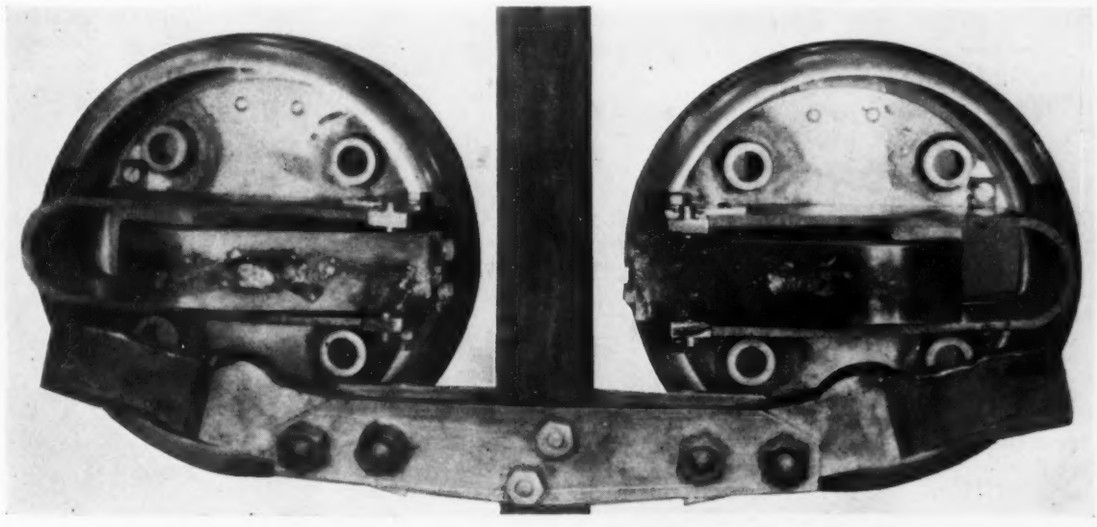
"Deïon grids" and moving contact used on 66-kv. tests

standing of power arcs and the theory of their extinction has been obtained.

Within the past year, through extensive research and thousands of laboratory tests, one of these new conceptions of how an arc may be extinguished in a liquid has resulted in a device known as the "Deïon grid." This device makes possible a practical high-voltage circuit breaker which insures improved performance with a minimum of gas and pressure, arcing time, oil deterioration and maintenance. The device consists essentially of stacks built up of alternate layers of insulating and magnetic materials, arranged in such a way that the arc is drawn in a narrow slot and held in this confined space by the magnetic field. Each stack is constructed of a number of units, each unit consisting of two layers of fiber, four layers of fullerboard, and one layer of iron. The number of units used is dependent on the voltage requirements, while the size and shape of the plates also can be varied to take care of current-interrupting requirements.*

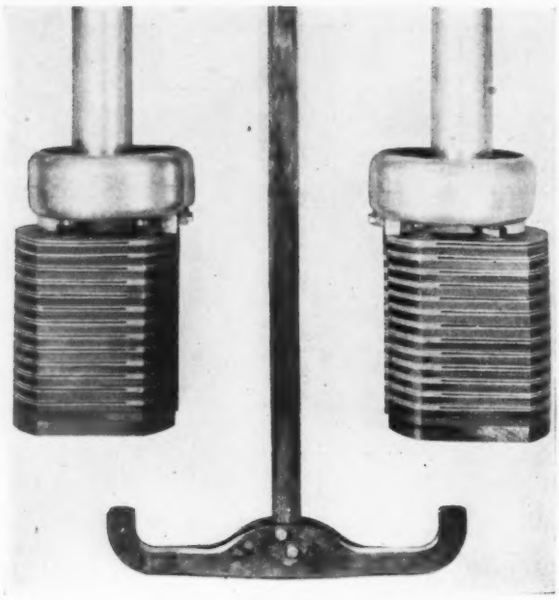
**See paper by Wilcox & Baker, "The Use of Oil in Arc Rupture," presented at midwinter convention A.I.E.E.*

When an alternating-current arc is drawn in oil the heat generated forms a gas, dependent on the current and voltage conditions. This voltage and current passes through zero twice in one cycle, and it is only at this moment that the arc can be prevented from re-establishing. If there is sufficient deionizing gas present to deionize the ionized path, the voltage cannot re-establish and the arc will not recur. In the conventional oil circuit breaker the arc creates a gas bubble which is highly ionized, and deionization of the arc cannot take place until fresh ions are supplied from the oil, or the separation of contacts prevents re-establishment. In the "Deïon grid" the units are so formed as to trap oil in pockets. The arc is drawn adjacent to these bodies of oil and driven in close contact with the fresh oil by the magnetic field. The majority of the generated gas can escape only



Stationary and moving contacts at the conclusion of the 66-kv. tests

This set of contacts opened 47 short circuits varying from 1,000 to 5,670 amp.



"Deïon grids" and contact arrangement used on 110-kv. tests

through the arc, resulting in rapid deionization of the arc path, preventing reignition of the arc.*

This structure was developed in the high power testing laboratory at East Pittsburgh, where tests were made from 15,000 to 220,000 volts with very promising results, the device interrupting all the power available at all voltages. The power available for these tests was 400,000 kva., which at the higher voltages did not give sufficient current to establish the real merits of the device. The results of these tests verified the design and theory of the "Deïon grids." It was desirable, in order further to prove the development of this device, to make several rather extensive sets of field tests on operating systems.

Tests at 66 kv.

Through the co-operation of the Duquesne Light Company the first tests were made at the Wilmerding substation on the 66-kv., 60-cycle transmission system, which is the largest 66-kv. operating system in the world. A total capacity of 240,000 kw. was available for test purposes, transmitted by four transmission lines which made possible tests at numerous current values. Complete testing equipment for oil circuit breakers is maintained at this substation, consisting of a permanent control installation, oscillograph equipment, accessories and an oil purifying system.

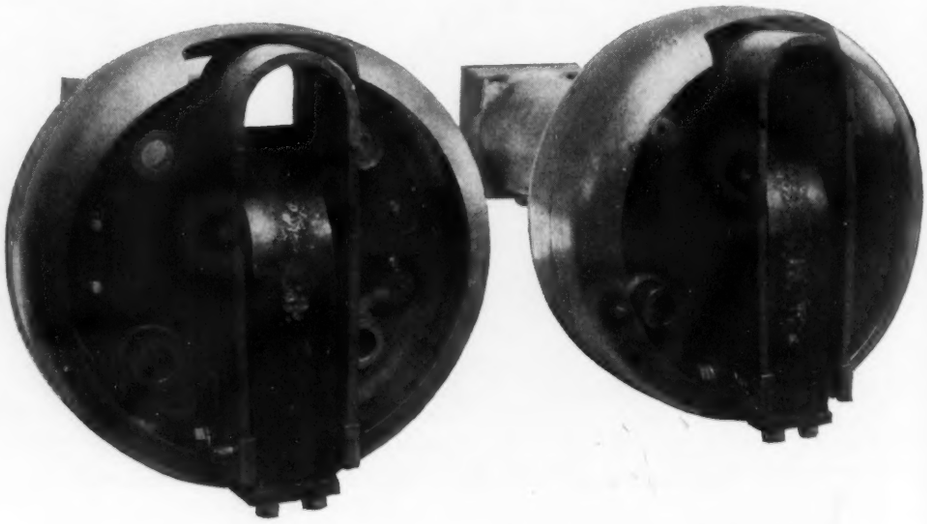
The tripping of the test breaker on the first tests was by overcurrent relays set for a minimum time of one cycle. On later tests, in order to reduce the duration of short circuit, the tripping impulse was made through an auxiliary switch on the closing mechanism, which reduced the short-circuit time several cycles.

A Westinghouse type "G-2" oil circuit breaker which had been in service for a number of years was used for the tests, it being supplied by the Duquesne Light Company and set up as shown in the accompanying illustration. The three-pole units were tied together mechanically and operated by a single 6-in. trip-free solenoid-operating mechanism. A contact position indicator of novel design, operating from the bell crank shaft, was so designed by the use of a miniature lever system that an oscillograph record gave true travel of the contacts.

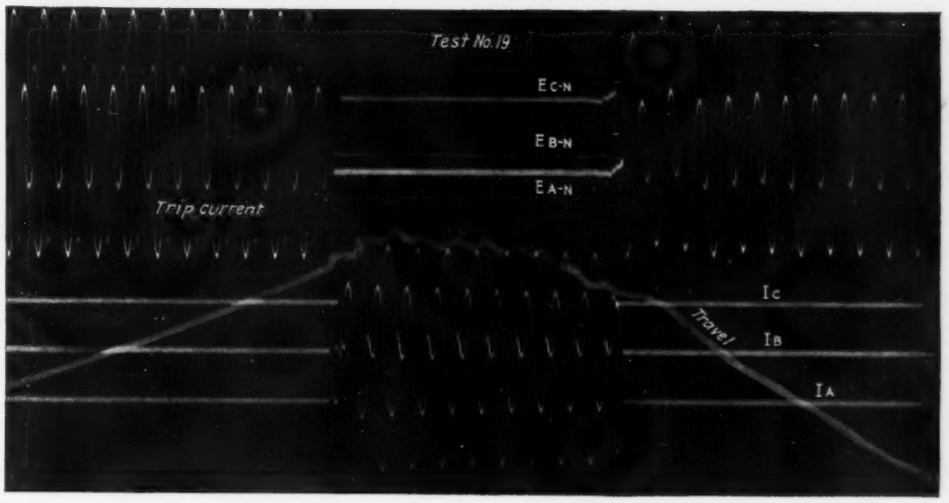
The conventional type contacts were replaced by the "Deïon grid" assembly, new moving contacts and guiding details. The contacts were so designed as to provide an arc-drawing member and a current-carrying contact. In operation the arcing contact makes first and breaks last, so that all burning takes place at this point. With the breaker ready for test the lift rod speed was approximately 8.0 ft. per second when the contacts were 25 per cent open or at the point where interruption should occur.

On October 6 the first series of tests was made, which consisted of 15-OCO operations, line-to-ground at current values from 1,000 to 5,600 amp. The breaker interrupted these short circuits without indication of distress. The only evidence of operation was movement of the position indicator, mechanical noise and a very slight puff of smoke from the exhaust pipe on two of the tests. One manhole cover leaked a few drops of oil, which was the extent of the oil loss. No movement of the breaker on the foundation was observed and was hardly expected from observation of the tests. Eight OCO tests next followed, with the full line voltage of 66 kv. across a single pole of the breaker, with current values varying from 2,380 to 6,970 amp. The operation was entirely successful, the breaker showing no distress

See paper by Dr. J. Slepian, "The Extinction of a Long A.-C. Arc," presented at midwinter convention A.I.E.E.



Stationary contacts after 110-kv. tests
Note the arc trails on the contact horns.



Oscillogram of a 66-kv., three-phase, ungrounded, OCO-duty cycle interrupting 3,730 amp.

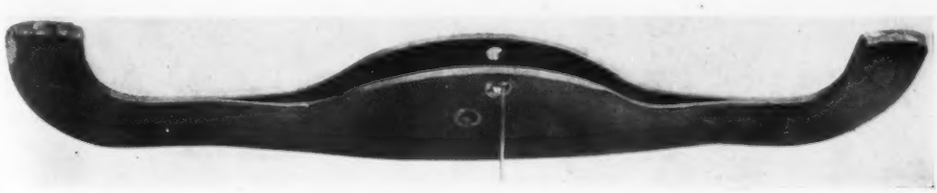
and losing no oil. Examination of the oscillograms showed better interrupting performance than on the line-to-ground tests.

Tests were continued the following day without inspection of the breaker, other than the taking of oil samples from the two poles used for previous tests. Twelve OCO, three-phase ungrounded tests were made, the current values ranging from 2,160 to 5,400 amp. The tests were made in pairs, on the 2-OCO duty cycle at two-minute intervals. The elapsed time for the twelve tests was one hour and thirteen minutes. The breaker operating indicator and the mechanical noise were the only indication of operation. The breaker opened these short circuits, some of which were the maximum available, without the least sign of distress or oil loss. The tests were concluded at this point and inspection made of the contacts.

The "Deion grids" showed no deterioration of any nature and were substantially in the same condition as before the tests. The arc-drawing contacts were burned a very small amount, considering the number of tests made. Due to improper adjustment of the moving contact the main current-carrying contacts were slightly burned. This resulted in the arc being drawn improperly and in one or two of the line-to-ground tests causing additional arcing. Drawing of the arc on the main contact results in a weak magnetic blow-in field, which requires additional time for movement of the arc to the point of deionization. No repairs or adjustments were necessary and none were made on either the "Deion grids" or the arc-drawing parts for the next series of tests. In Table I are tabulated results of a number of the tests, which are representative of the entire series. The arcing time for this series of tests varied from 0.5 to 3.5 cycles (60 cycle), with not a great deal of difference being noted between the various test conditions. The average arcing time for the 35 tests was 1.8 cycle. The single phase-to-ground tests show slightly more arcing time than the other two series.

A word of explanation is probably necessary regarding arcing time. The tabulated figures of arcing time give only that which is clearly shown on the oscillograms. Experience indicates that there is additional arcing of such a low voltage that it does not appear definitely on an oscillogram. This probably amounts to one cycle on these tests and should be borne in mind when reviewing these results. A pressure indicator used on one pole, arranged to measure pressure at the bottom of the tank, recording the results on the oscillogram, gave no indication of pressure. The average arc length was approximately 6 in. for the two arcs in series, making the volts interrupted per inch about 7,000 to 10,000. The improved performance of this device is readily visualized when the conventional breaker is considered from this standpoint. On the same circuit 1,500 to 2,500 volts per inch is an average figure for the conventional oil circuit breaker. Reclaimed WEMCO C oil was used for the tests, the dielectric tests being 24, 22 and 20 kv. on phases "A," "B" and "C" respectively, the samples being taken from the bottom. At the conclusion of the tests the oil tested 21, 18.0 and 18.5 kv. on phases "A," "B" and "C" respectively, taken from the same source. Twenty-seven interruptions were made on phase "A," twelve on phase "B" and twenty on phase "C." Oil samples were taken from the vicinity of the "Deion grids" and tested slightly lower. On phase "A" the test was 19.2 kv., on phase "B" 18 kv. and on phase "C" 18.1 kv.

An oscillogram of a three-phase test is shown in an accompanying illustration and is the typical performance for the "Deion grid" oil circuit breaker. This oscillogram shows a three-phase, ungrounded test at 66 kv., interrupting an average current of 3,730 amp. with two cycles of arcing. Only the last half cycle of arcing shows any noticeable arc voltage. The travel curve shows the circuit interrupted in about 20 per cent of the travel.



Moving contact after 110-kv. tests at Birmingham, Ala.

TABLES I AND II—TYPICAL TESTS ON 66-KV., 60-CYCLE SYSTEM

Westinghouse Type "G-2" "Deion grid" Oil Circuit Breaker

Duquesne Light Company, Pittsburgh, Pa., October 5, 1929

Lift Rod Speed 8.0 Ft. per Second.

LINE-TO-GROUND TESTS

Test No.	Duty cycle	Amperes interrupted	Duration of short circuit, cycles	Relay time, cycles	Arcing time, cycles
1	OCO	1,050	10.0	0.5	2.5
2	OCO	1,040	11.0	0.5	3.5
3	OCO	1,030	8.0	0.5	2.0
6	OCO	3,520	8.0	0.25	1.0
8	OCO	3,610	9.0	0.25	1.5
10	OCO	5,380	11.0	0.25	3.5
11	OCO	5,300	9.5	0.25	2.5
15	OCO	5,400	10.5	0.5	2.0

LINE-TO-LINE TESTS

16	OCO	2,380	9.0	0.5	1.0
17	OCO	2,380	10.0	....	2.0
20	OCO	6,730	11.0	0.5	3.0
21	OCO	6,870	9.0	1.0	1.0
22	OCO	6,720	9.5	1.0	1.5
23	OCO	6,970	9.5	1.0	1.5

THREE-PHASE TESTS

24	OCO	Ph.A. 2,160	....	....	1.5
	.....	Ph.B. 2,320	....	....	1.5
	.....	Ph.C. 2,420	9.5	0.5	1.5
28	OCO	A. 4,170	....	....	1.5
	.....	B. 3,770	....	....	1.5
	.....	C. 3,650	9.5	0.5	1.5
35	OCO	A. 5,400	9.5	0.5	1.0
	.....	B. 4,570	....	....	1.0
	.....	C. 5,170	....	....	1.0

Duquesne Light Company, Pittsburgh, Pa., October 12, 1929

Lift Rod Speed, 7.0 Ft. per Second

LINE-TO-GROUND TESTS

1	CO	1,050	12.0	5.0	1.5
2	OCO	1,050	12.5	5.0	1.0
3	CO	1,050	12.0	5.0	1.5
22	OCO	3,100	11.5	4.0	2.0
24	OCO	3,250	11.0	3.0	1.5
25	OCO	3,250	10.5	....	2.0
42	OCO	3,740	10.5	3.5	2.0
44	OCO	3,740	11.5	3.0	2.0
47	OCO	3,740	9.0	....	2.0

THREE-PHASE TESTS

31	CO	Ph.A. 3,740	....	....	1.5
	.....	Ph.B. 3,600	....	....	1.5
	.....	Ph.C. 3,480	10.5	3.5	1.5
34	OCO	Ph.A. 3,700	....	....	2.0
	.....	Ph.B. 3,660	....	....	1.5
	.....	Ph.C. 3,500	11.0	3.5	2.0
38	OCO	Ph.A. 3,870	....	....	1.0
	.....	Ph.B. 3,740	....	....	1.5
	.....	Ph.C. 3,700	10.5	....	1.5

On October 12 another series of tests was made testing three phase and line-to-ground, making a larger number of tests and in a shorter time. A 4-in., non-automatic mechanism operated the breaker on these tests, a lift rod speed of 7.0 ft. per second being obtained when the arc was extinguished. No other changes were made in the breaker. Twenty tests were made at two-minute intervals, six CO and fourteen OCO, line-to-ground, at approximately 1,000 amp. Without inspection of the breaker, ten tests were made immediately, two CO and eight OCO, line-to-ground, at two-minute intervals at a current of approximately 3,300 amp., followed by ten tests, two CO and eight OCO, three-phase, ungrounded, at two-minute intervals at a current value of approximately 3,700 amp. Connections were changed and ten tests, two CO and eight OCO, were made line-to-ground, at two-minute intervals at a current value of 3,700 amp. The total elapsed time for the 50 tests was two hours and eighteen minutes. No distress of any nature was noticeable on any of the tests, except for a slight puff of smoke from the exhaust pipe on a few of the shots. Inspection of the "Deion grids" showed them to be in substantially the same condition as before the tests and were capable of indefinite service. No additional burning appeared on the main current-carrying contacts as was experienced on the first series of tests. The arcing contacts, of course, showed additional burning, which was expected.

TABLE III—TESTS ON 110-KV., 60-CYCLE SYSTEM

Westinghouse Type "G-2" "Deion grid" Oil Circuit Breaker.

Alabama Power Company, Birmingham, Ala., November 3, 1929.

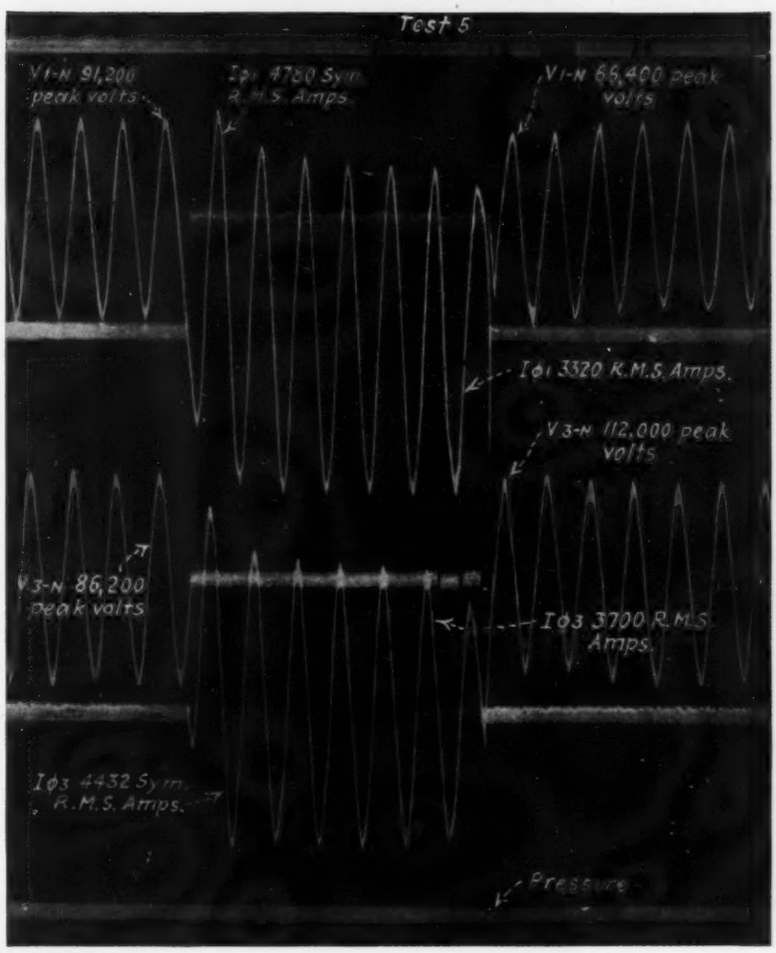
Test No.	Short circuit	Duty cycle	Duration of short circuit, cycles	Interrupted r.m.s., amperes			Cycles of arcing			Interrupted-kva. three-phase basis
				Ph.1	Ph.2	Ph.3	Ph.1	Ph.2	Ph.3	
1	Three-phase	OCO	15.5	896	910	904	3.5	3.0	4.0	172,000
2	Three-phase	OCO	13.0	2,340	....	2,680	0.5	...	1.5	478,000
3	Three-phase	OCO	13.0	2,800	2,920	2,820	1.5	1.5	1.5	543,000
4	Three-phase	OCO	13.5	3,560	3,640	3,500	1.5	2.0	1.5	680,000
5	Three-phase	OCO	13.5	2,750	3,380	3,020	1.5	1.5	2.5	582,000
6	Three-phase	CO	13.0	2,630	3,000	3,120	1.5	1.5	1.0	555,000
7	Three-phase	OCO	6.0	3,260	3,520	3,500	...	0.5	1.5	654,000
8	Three-phase	OCO	7.0	3,300	3,860	3,700	...	2.0	1.0	692,000
9	Three-phase	OCO	7.5	3,320	3,840	3,700	...	2.0	1.5	690,000
10	Three-phase	OCO	7.0	3,200	....	3,650	...	...	2.5	653,000
11	Line-to-ground	OCO	7.0	....	3,740	....	...	1.5	...	715,000
12	Line-to-ground	OCO	7.0	....	3,800	....	...	1.5	...	725,000
13	Line-to-line	OCO	8.0	....	3,480	....	...	2.0	...	1,160,000
14	Line-to-line	OCO	8.0	....	3,540	....	...	1.5	...	1,170,000

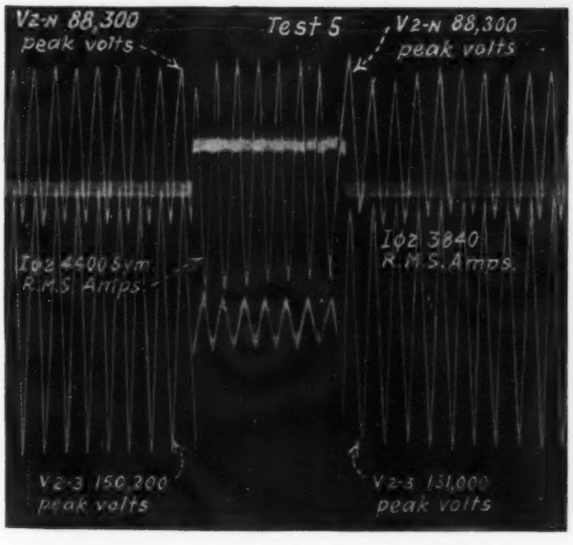
Tests 1 to 6 inclusive tripped with overload instantaneous relay set for 2 cycles. Tests 7 to 14 inclusive tripped with auxiliary switch on closing mechanism

Oil Tests
Before—25 kv. After—25 kv.

Table II shows a number of these tests, typical of the entire series. The arcing time varied from 1.0 to 3 cycles, averaging 1.9 cycles for the 50 tests. Considering the two series of tests, the difference in breaker speed of 1 ft. per second did not affect the breaker operation to any noticeable degree, the performances being practically identical. The dielectric values of the oil before the tests were 21.6, 22.0 and 21.6 kv. on phases "A," "B" and "C" respectively. After the tests the oil showed practically no decrease in dielectric strength, being 21.6, 21.0 and 21.3 kv. on phases "A," "B" and "C" respectively. This fact alone is a remarkable performance, considering that twenty phase interruptions were made on phase "A," 30 on phase "B" and twenty on phase "C."

The accompanying illustration shows one set of the current-carrying contacts at the conclusion of the tests. This set of contacts is from phase "A," on which 47 phase interruptions were made, with current varying from 1,000 to 5,670 amp. This view shows the small amount of burning associated with this device. The improper adjustment of the main contact accounted for the burned area under the hinge pin. This was remedied on the latter series of tests.





Oscillograms of a 110-kv., three-phase ungrounded OCO-duty cycle

The average current interrupted is 3,260 r.m.s. amperes.

In order to obtain further information on the performance of this device at higher voltages, tests were made by the Alabama Power Company at Birmingham, Ala., on its 110-kv., 60-cycle system at Bessemer substation. A total generating capacity of 535,000 kva. was available for the tests furnished by six generating stations. A synchronous load of 47,500 kva. was also connected for the heavier tests.

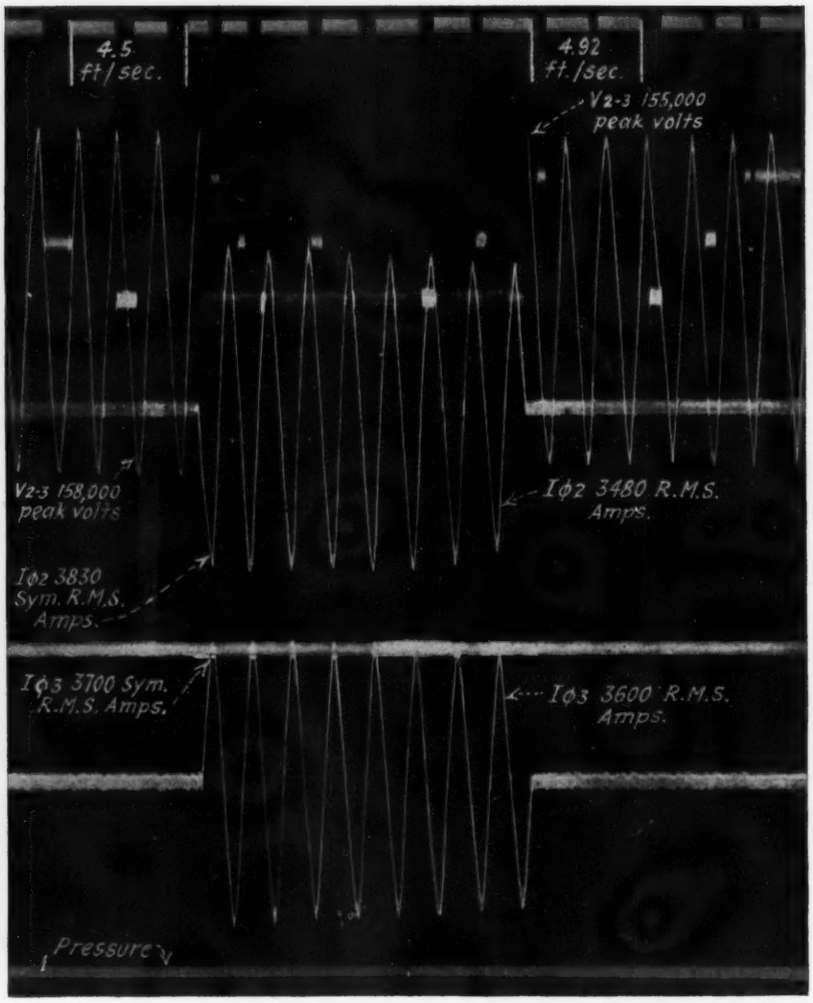
Complete testing equipment is maintained for testing oil circuit breakers, including an elaborate oscillograph set-up for recording the various records, a complete relay and control scheme for timing the operations and an oil filtering and supply system.

A Westinghouse type "G-2," 110-kv., three-pole breaker, rated at 600,000 arc kva., which had been in service for nine years, was used in these tests. The old contact arrangement was removed and "Deion grid" contacts assembled in the breaker. A 6-in. full-automatic mechanism was also provided, which increased the breaker speed to approximately 5 ft. per second at the time of circuit interruption. The design of the moving contact was improved over that used in the Wilmerding tests and is shown in an accompanying illustration. This form provided a more positive arc-drawing member and eliminated any possibility of the arc being drawn outside of the magnetic field.

Overcurrent relays set for 2-cycle operation were used for timing the breaker operation on the first seven tests, while an auxiliary switch on the closing mechanism tripped the breaker on the last eight tests. The latter method reduced the duration of short circuit approximately 6 cycles.

Ten three-phase, ungrounded tests, nine of which were OCO-duty cycle and one CO, were made with currents varying from 900 to 3,800 amp. In addition, two OCO tests, line-to-ground and two OCO line-to-line tests across a single pole were also made at currents of approximately 4,000 amp.

The entire series of tests was made without the least signs of distress, oil throwing or gas formation. The only indication of breaker operation was the operation of the position indicator and mechanical noise, while the only indication of a short circuit was the blinking of the substation lights. A sheet of paper placed under each exhaust pipe to indicate leakage during the tests revealed no sign of oil. This method of determining oil loss gives a splendid contrast between the performance of the "Deïon grid" breaker and the conventional type used in the past. The writer is at a loss to recall when such an exacting method was used in the past to determine whether oil was lost in a circuit breaker test.



Oscillogram of a single-phase, 110-kv. OCO-duty cycle across a single pole of the breaker

Inspection of the "Deïon grids" showed them to be in perfect condition, except for slight burning on the contacts, which of course is to be expected. Illustrations show the "Deïon grids" after the tests and the moving and stationary contacts and the small amount of burning resulting from this series of tests.

In Table III the results of the tests are tabulated. The maximum arc kva. interrupted on the three-phase tests was 692,000, which is 115 per cent of the breaker rating. The equivalent kva. on a three-phase basis interrupted on the line-to-line tests with 110,000 volts across a single pole of the breaker was 1,170,000. This is practically double the interrupting capacity. Considering the remarkable performance on these tests, the efficiency of the "Deïon grids" is well demonstrated. The total duration of short circuit when using instantaneous relays was approximately 13.5 cycles. Deducting the relay time of two cycles, the breaker operation was completed in 11.5 cycles, which is a short time for this slow speed breaker. With the exception of the first test at 900 amp., the average arcing time for the fourteen tests was 1.5 cycles. The dielectric tests on the oil showed no deterioration in breakdown strength, it testing 25 kv. in a standard test cup before and after the tests.

Oscillograph records are shown in an accompanying illustration of an OCO, three-phase, ungrounded test at 110 kv. interrupting an average current of 3,620 amp. with an average arcing time of 3 cycles. A feature of the "Deïon grid" is shown by this oscillogram, in that the arc voltage is exceptionally low, resulting in little arc energy being dissipated in the oil. No pressure was developed by the interruption of this short circuit as indicated by the pressure record.

An oscillogram is given showing a line-to-line OCO test, interrupting 3,480 amp. at 110 kv. across a single pole of the breaker, with 2 cycles of arcing. The arc voltage is exceptionally low on this test and explains why the use of this device results in low oil deterioration, little pressure and disturbance in interrupting heavy short circuits.

220-kv. tests

The performance of the "Deïon grids" on the 66- and 110-kv. tests gave every indication of being well adapted for interrupting a short circuit in a minimum time. The total time required to clear a short circuit is divided into three parts: First, the relay time; second, the time from energizing the trip coil to separation of the arcing contacts; third, the time from separation of the arcing contacts to interruption of the circuit. The "Deïon grids" furnish an interrupting medium in which the third factor can be made a minimum, thereby realizing a total breaker time of 8 to 10 cycles (60-cycle basis).

A further report of Deïon breaker performance by Mr. Dyer will appear in an early issue.

Public Control of Power

Notables differ on utility regulation in interesting symposium. No conclusions reached. All parties advocate opinion policies

THE Academy of Political Science made "Public Control of Power" the exclusive subject of its deliberations at three sessions of an all-day meeting in New York last week. Practically every shade of opinion on this unsettled subject was presented, the speakers embracing most of those who have been foremost in the recent surveys to evaluate the efficacy of utility regulation by the states. In general, the ideas were the same as those advocated by them in the past in their official or professional capacities, but the juxtaposition of the conflicting views served to accentuate the discordances and the need for a more evident common denominator.

Dean Mosher of Syracuse University recalled the chaos of 25 years ago and, after accounting for the introduction of utility regulation, recited the manifest accomplishments of the regulatory commissions. The accelerated investigations of 1929-30 have, however, revealed shortcomings and defects which, in his opinion, necessitate an enlargement of commission authority. Absence of control over holding companies, absence of any recorded basis of fair value (except book value) and little foundation for ascertaining propriety of charges for the various classifications of service are among these defects. Likewise, the controversy about the essential function of the commissions, shall it be administrative, or shall it be judicial—has tended to obscure the representative and prosecutive capacity and obligation. Dr. Mosher pleaded for enlarged staffs to enable a dynamic spirit of research on the part of the commissions.

The institution of regulation removed most of the evils current at the period and to a large extent the commissions have performed their intended function of fostering adequate service at reasonable rates. This was the view of H. C. Spurr, editor of *Public Utilities Reports*. All the accusations of regulation breakdown are based on acute differences of opinion on the reasonableness of rates. Measuring the efficacy of regulation in much the same way as investments are rated, he urged that $7 in saved rate payments by consumers because of commission rate reductions was a distinctly good return on the $1 invested in commission salaries and expenses. Another measure of the efficiency of regulation is the paucity of cases appealed from commission decisions to the courts. Only two cases which involved the question of rates and fair value were appealed in New York state between 1921 and 1928 out of 11,440 formal orders issued by the commission.

It was pointed out by Prof. John H. Gray of American University, Washington, that the United States has a tenacious belief in the efficacy of competitive selling to keep prices at fair levels. True competition is, however, a minor occurrence in the bulk of American business practice today; consequently, the distinction between the regulated public utility business and the ordinary unregulated business enterprise is very largely a legal fiction and lacks an economic basis. In his opinion the construction placed on the fifth and fourteenth amendments of the constitution when applied to cases arising out of utility regulation has destroyed all chance for effective regulation. In fact, the term "fair" is an ethical one and not an economic one. "Value," on the other hand, is an economic concept. The term "fair value" is therefore an incongruity. Courts speak of "finding" value as glibly as they might of finding a lost dog. His conclusion was that *as long as valuation remains the basis of rate fixing the industry will regulate itself more effectively than the state will be able to. The holding companies must be forced to accept federal incorporation and the capital structures must be greatly simplified.*

The state should abandon all idea of specific fixing of rates, focus on the discrimination phase and exercise a check through the medium of a direct profit tax.

The essential exercise of judgment and discretion in commission rate fixing makes the process distinctly a judicial one, in the opinion of William A. Prendergast, late chairman of the Public Service Commission of New York. State regulation is still in a state of development. There are many matters before the commissions which call for the administrative and quasi-judicial treatment, only a small portion of the business being rate cases. The greater proximity of the rate case to judicial review makes that particular function of the commissions savor strongly of judicial status. The prosecutive obligation never was a proper concept and never will be; adoption of it would throw many more cases into the courts and confound those who, while advocating it, decry the resort to the courts. He also questioned the effort to confirm the frail and phantasmagorical economic concept of prudent investment.

In the discussion which concluded the morning session Samuel Ferguson, president of the Hartford Electric Light Company, raised the very pointed query whether

the present program is one of regulation of rates or regulation of profits. It appears to aim more at regulation of profits, with the assumption that modest profits will result in proper rates.

Value is an economic fallacy and impossible of administrative ascertainment, in the opinion of Prof. J. G. Bonbright of Columbia, one who participated in the minority report of the New York investigative commission. Value is an index of profitableness and its application involves circular reasoning. The doctrine of the Supreme Court is therefore an economic absurdity, because it excludes from rate determinations the one factor that establishes value in any other business enterprise, namely, profitableness. A fundamentally divergent program of rate regulation is demanded by the present circumstances. The various experimental possibilities available are governmental ownership and operation, local community ownership and control, the adoption of the actual cost principle, or the adherence to the proposal of the late President Hadley of Yale University that rates be determined on a purely relative basis without regard to profits. *The mere fact that several companies have voluntarily abdicated the right to claim rates that would bring a fair return on fair reproduction value was cited by him as conclusive proof of the breakdown of regulation.*

Martin J. Insull, president of Middle West Utilities, called attention to the development of the country in the last 30 years as exceeding the wildest dreams of the past and claimed for the electrical industry the position of leadership in this unfolding of the nation as an industrial and social success. Its very success tenders a challenge to the reformer, but it does not appear that the reform proposals are based on public demand. Certainly there has been no slackening of the demand for the securities of the utility companies. "If regulation is a failure, then the only alternative is government ownership." This stock phrase of the reformer seems to indicate the ultimate aim of the reformer, to be accomplished by indirection and attrition. It is no sign of breakdown that in spite of regulation, oppressive at times, the regulated industry has grown and attained such financial credit and stability as to attract the immense amount of capital required. He prefers to call the holding company a utility investment company which exercises the prime function of supplying the equity capital needed to finance the expansion of the industry. *No reason is apparent why there cannot be a full and amicable understanding between the commissions and the operating companies as to the validity of the charges for power and services of the holding company. Nor is there any connection between the securities of the holding company and the rates charged by the operating company.* Every enlightened utility executive has the ambition to render the best possible service at the lowest possible rates consistent with adequate credit standing.

Contract method debated

Interpretation of the contractual principle of rate regulation was given by Randall J. LeBoeuf, general counsel of the Niagara Hudson Power Corporation. There is little new about this except the proposal to extend it to household rates, because only about 15 per cent of his company's output is now not sold on a contract basis, with prices fixed by competitive considerations. *The contractual procedure applied to the household rate might be successful, but politics would have to be obliterated from the picture. Any proposal to coerce the utility to sign would result in a demand for the right to earn on the present-value portion of the property, because after a few years most of the property extant would be classified in the additions and betterment group.*

Reproduction cost has nothing to do with the problem of attraction of capital; the return on his investment is what attracts the investor to invest. This was the view of Prof. Robert L. Hale of Columbia University. It was elaborated upon by Lewis Goldberg, member of the Department of Public Utilities of Massachusetts, who expounded the sustained practice of that state in applying the prudent investment theory. He asserted that it was wholly successful, only four rate cases having been appealed to the courts, although the reproduction value had been urged at times by ambitious utilities. Any enhanced emphasis on this desire would arouse in Massachusetts the Boston tea party spirit and precipitate government ownership. The state is not excited about holding companies because the method of regulation minimizes the influence of holding company capitalization and profits. *Nor is there the least call for federal regulation of the holding companies. Mild entrance of the federal government into the electrical field by this route will surely terminate in the complete pre-empting of it, as has happened with the railroads. Interstate transmission of energy is too small to justify federal regulation of that practice.*

Utilities are not complete monopolies. They must compete for labor, capital and the consumer's dollar.

Col. William J. Donovan pointed to the fact that our recourse to commission regulation followed a period in which national thought was committed to free enterprise and minimum intrusion of government into business. Today, however, the utility services are necessary goods, not wanted for their own sakes but for their contribution to general industrial and social performance. The regulatory theory assumes the utilities to be a complete monopoly, free of all competition. This is not true. They have to compete for labor, compete for capital and compete for the customer's dollar. In his opinion the state has hired the corporation to perform a task which it is unable or unwilling at the moment to undertake itself. It is therefore the obligation of the state to facilitate the acquisition of the capital; it is not necessary to view the protection of the investor as incompatible with the protection of the consumer, or vice versa.

Valuation is, of course, the moot question in the whole matter of regulation. The Supreme Court prescription is difficult of administration and at times has worked hardship on both consumer and investor. The present high price level is the reverse of the situation existing in 1899, when low reproduction cost was urged by the public as the true index of rate base. It is dangerous, therefore, to write into law any fixed theory of rate regulation. In fact, enlightened utility management recognizes the identity of the interest of the consumer and the investor and many rates today are lower than adequate to provide a return on reproduction value. Regulation is a problem of statecraft in its broadest sense and not one

of theoretical formulism. *Efforts to alienate constitutional rights or impose penalties become mere coercion and are not regulation.* They lead to irritation, antagonism, economic waste.

Colonel Donovan advocates self-imposed utility discipline tempered with a co-operative spirit on the part of the state. Partnership is the keyword. The utilities are the economic servants of the public in the same sense that the governmental officers are the political servants of the public. In the field of regulation the conference table must supplant the political rostrum.

Federal courts defended

The acceptance of jurisdiction by the federal courts in certain public utility rate cases was vigorously defended by Judge Martin T. Manton, presiding judge of the United States Circuit Court of Appeals. With reference to the suggestions that Congress move to deprive the courts of some of their prerogatives in this field, he said *it was difficult for any student of the law and impossible for a constitutional lawyer to conceive of any way that Congress may take from the federal courts their power and duty to protect a property threatened with confiscation by any regulatory body.* The selection of the federal court instead of a state court for litigating rate controversies has caused much public resentment. The cry of interference by the national courts has been loud and wide. But this antagonism to the exercise of jurisdiction has been the exception and not the rule.

The New York investigation has brought out two clear evidences of need for review of the regulatory practice. The procedure in rate case needs to be simplified and accelerated. The problem of the holding company, on the other hand, is not serious, because no holding company can for long mulct the operating company. *The critics of regulation are really critics of the state and federal constitutions. They are really advocates of progressive and piecemeal government ownership hiding under a disguise. They seem to be unwilling for the public to realize that it would take about four billions of state capital to take over the utilities of the state of New York and the loss in taxes, direct and indirect, out of the utility business would be over $50,000,000 per year.* The Ontario enterprise was often brought into the discussion and F. L. Carlisle essayed to tell the truth about it as he sees it. In 1928 the Hydro-Electric Power Commission of Ontario sold 3,061,000,000 kw.-hr. for $32,000,000 in cash. In the same year the Buffalo, Niagara & Eastern Power Company sold 4,400,000,000 kw.-hr. for $32,900,000 and paid $4,500,000 of that to the state in taxes. Thus the American company sold 30 per cent more kilowatt-hours for $4,500,000 less money when its business is compared to that of the Ontario commission.

New York is in an extremely fortunate situation from the power standpoint. Nature created within its borders the greatest and cheapest hydro-electric potentialities immediately adjacent to the greatest actual and potential market in the world. These water powers remain largely undeveloped, however, because of governmental restraint. *And the road to proper development of this power and fair price for its sale is not the road of rigid law. The law never attracted business. Business will be attracted by making the power available and encouraging its maximum utilization.*

The utilities are wholly sold on the idea that the greatest force in the United States today is an enlightened public opinion. This is sure to be the guiding motive in the future of the electric utility business to an extent only partially true in the past. This is the real hope, a full, generous policy of publicity, with frankness about all its deeds and contemplations.

SOME OF THE PARTICIPANTS IN THE SYMPOSIUM ON UTILITY REGULATION

William A. Prendergast

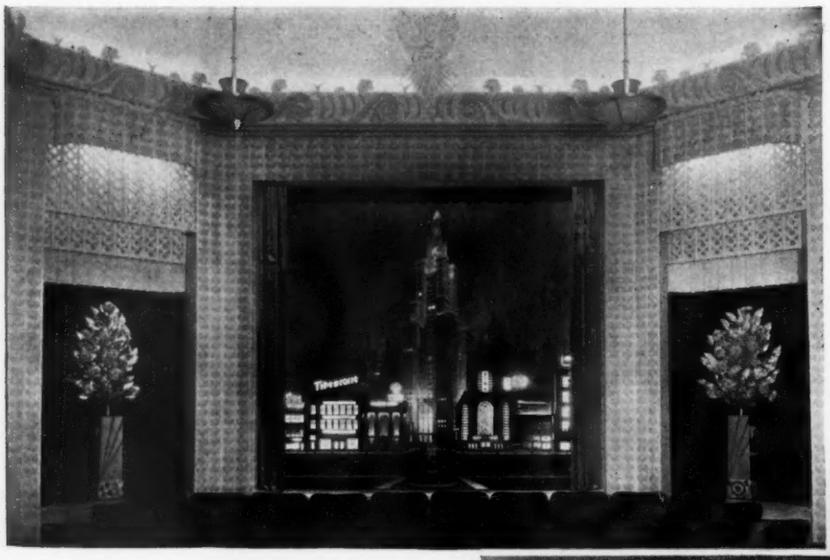
W. J. Donovan

F. L. Carlisle

W. L. Ransom

Martin J. Insull

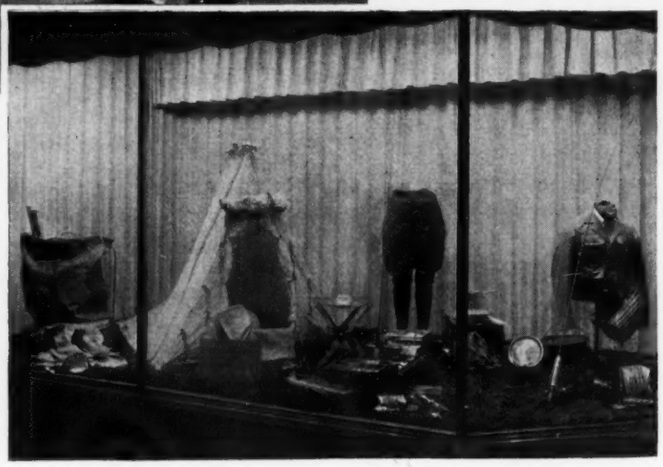
A Lighting for the



The general illumination of this auditorium, which seats 200, can be varied over a wide range of intensities and effects by the combination fixtures hung from the ceiling. Each of these fixtures is wired for 2 kw. and contains 35 lamps. The cove lighting is arranged for automatic color changes, as are also the three planes of filigree on the sides of the stage. The mobile colors on the filigree make a remarkable effect. The stage set, which is removable, shows a city skyline and includes all forms of electric signs and building floodlighting.

A most pleasing part of the institute is the model home of seven rooms, where the domestic applications of light are beautifully displayed. The only difference between this and any other well-planned modern home is the installation of the bare-lamp fixtures which, by contrast, bring out the virtues of shaded light.

Light is used in this lounge and conference room as a decorative and atmosphere-producing medium effectively, but with restraint, so that there is no obtrusively spectacular impression created. The downward illumination in the alcoves will bring out the colors of paintings to be hung later. The cove lighting on the ceiling may be controlled to flood the room with a wide range of gradations of color.



This store window is equipped to show the possibilities of color and contrast in store front display. Another, not illustrated, is arranged for the demonstration of intensities as high as 1,033 foot-candles. The back drop may be flooded with light from top and bottom and items on display picked out in colors by the use of spotlights.

Institute Middle West

Occupying the entire thirty-sixth floor at 20 North Wacker Drive, Chicago, the Institute is most advantageously located. The building, best known as the home of the Chicago Civic Opera and Civic Theater, is rapidly becoming the electrical center of Chicago. Utility companies, both holding and operating, and electrical manufacturers have offices in the building. It also houses the Electric Association of Chicago and the Electric Club.

THE Chicago Lighting Institute enjoys a distinction from others so far established. It is a co-operative institution where are brought together the interests of manufacturers, electric utilities and contractors. This fusion of interests is not by the fact that the institute's facilities are open to any and every group that wants to make use of them, but because each group has a financial stake in it and is an owner. The equipment of the institute is as modern as tomorrow and it will be kept so as advances in the lighting art are made.

Special applications of light for the attractive display of merchandise are shown in this store interior. The values of various intensities can be shown in the general illumination and in the cove and showcase lighting. Comparisons between daylight type and ordinary lighting are possible, as are also contrasts between the display effectiveness of goods against dark and light backgrounds. The fitting room in the right-hand corner is equipped with shadowless illumination so that there can be no mistake about the hang of a dress or the fit of a coat.

Twelve types of industrial lighting, including 10-kw. lamps, are shown in this room. The lamps furnish 260 foot-candles of the 417 which it is possible to demonstrate in this room. Pulley-hung units permit showing the effects of lamp-mounting heights on working-plane light intensities. Special hangers and other lamp maintenance and replacement devices are demonstrated, as are also the characteristics of different types of units and light-directing equipment.

The institute is intended to be an electric illumination laboratory for the Middle West. This intention is forwarded by the membership in the institute of practically all the electric utilities with headquarters in Chicago and whose operating territories cover a vast area in the central, southern and western parts of the United States. Manufacturers and distributors of lighting equipment are also included in the membership. Interests of contractors, retailers and architects

are maintained through the membership of the Electric Association of Chicago.

Equipment for the demonstration of all forms of home, commercial, industrial and outdoor lighting is provided in the institute. Each of these applications of lighting may be demonstrated over wide ranges of intensities, colors and forms. In addition to the demonstrations, installations and equipment, the institute has study rooms for classes in lighting theory, a theater for lectures and special displays and lounge and conference rooms.

The officers of the institute are: E. W. Lloyd, president; John G. Learned, vice-president; O. R. Hogue, secretary-treasurer. Ralph Raymond is managing director and E. D. Tillson is technical director. The members are: Benjamin Electric Manufacturing Company, Bullesby Engineering & Management Corporation, Central Public Service Corporation, Commonwealth Edison Company, Curtis Lighting, Inc., the Electric Association of Chicago, General Electric Company, Middle West Utilities Company, Midland United Company, North American Light & Power Company, Public Service Company of Northern Illinois, United Light & Power Engineering & Construction Company and the Westinghouse Lamp Company. The institute was formally opened on April 11 by Samuel Insull, Jr., following a dinner at the Union League Club, at which Mr. Insull was the principal speaker.

▼ ▼ ▼

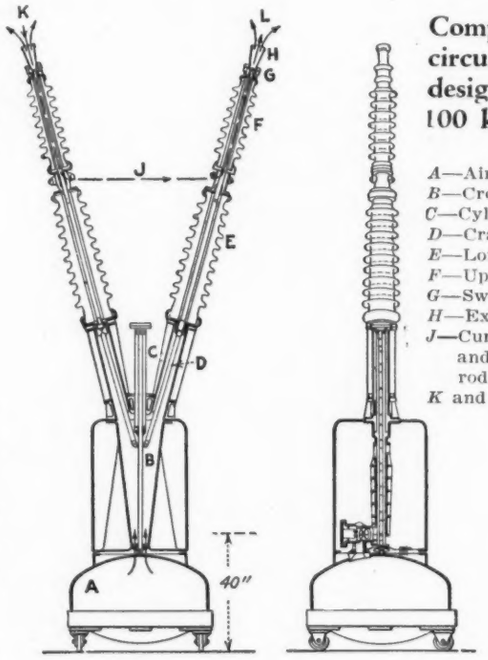
100,000-Volt Arc Ruptured by Air Jet

TO BREAK with ease and absolute safety 1,500,000 kva. at a potential of 100 kv. without the use of oil or any other liquid dielectric is an achievement worthy of note. ELECTRICAL WORLD reported a short time ago of a German concern which has successfully developed and placed on the market a new type of high-power circuit breaker which is air insulated and in which the opening arc is extinguished by a violent jet of air. At that time 10,000 volts was the highest voltage. Further research indicated that the same astoundingly simple dart contact and properly directed air-jet principle can be used for voltages up to 50 kv., rupturing within half a cycle up to 500,000 kva. Further investigations, as reported by J. Biermanns in the February 27, 1930, issue of the *Elektrotechnische Zeitschrift* showed that with two such air breaks up to 100 kv. can be safely ruptured within half a cycle, in spite of up to 90 kv. returning potential. A large number of tests, rupturing currents of 3,000 to 8,000 amp. at 100 kv. per pole, showed a remarkable uniformity of the break character.

The 100-kv. single-pole breaker now on the market, which is shown in outline, differs greatly from the customary oil type. Essentially the switch comprises two tandem arrangements of 100-kv. porcelain bushings, mounted on top of a steel frame at about 35 deg. inclination. Near the top of the upper bushings, and located inside of them, are the hollow conical stationary contacts, into which engage the movable darts, placed at the ends of metallic rods. To these rods are joined insulating rods, extending through the full length of the lower part bushings, where they attach to two crank rods and a crosshead. The latter connects to the vertical operating rod of the piston in a compressed air cylinder, standing upright between the pair of bushings.

With pressure admitted at the top of the cylinder, piston and crosshead will be thrown rapidly downward, causing the withdrawal of the two darts. Simultaneously a large amount of compressed air is admitted concentrically with the axis of the two bushings, which extinguishes the two ensuing arcs with such rapidity as to prevent reignition at the next half cycle. To supply the operating cylinder and the two air jets with an unimpeded stream of air, a large air reservoir forms the base of the switch, thus avoiding any articulated air lines. The reservoir itself is connected with a relatively small pipe line to the station supply of compressed air.

A switch of this rating attains a height of more than 16 ft., with the lowest live part about 10 ft. above ground, and therefore well out of reach. Since the breaker illustrated will open with a very sharp report, installations near settled territory are equipped with an automobile type muffler, which fits to the top of the bushings and deadens the report to a satisfactory degree.



Compressed-air circuit breaker designed for 100 kv.

A—Air reservoir
B—Crosshead
C—Cylinder and piston
D—Crank rods
E—Lower bushings
F—Upper bushings
G—Switch contacts
H—Exhaust
J—Current connection and mechanical tie-rod
K and *L*—Line leads

Mr. Biermanns emphasizes the rising potential danger, inherent in all oil type circuit breakers, with the present trend of increasing demands made upon the rupturing capacity of breakers in large power centers. Failure of such a switch, he points out, is usually accompanied by grave mechanical and fire destruction, caused by large quantities of oil present. For medium voltages the air switch is somewhat more expensive than the electrically equal oil type. But the additional cost is more than offset by the possibility of much smaller spacing requirements due to the total absence of fire danger. Above 50 kv. the air type is cheaper, with all the other advantages to boot. Operating experiences, with over 50 of such air breakers installed, and results of laboratory tests with still higher voltages, indicate beyond doubt a bright future for the oil-less type of high-voltage, high-power circuit breaker, Mr. Biermanns contends.

Creosote Treatment of Southern Pine*

By THOMAS A. WILSON and EDGAR F. WOLF

Superintendent Timber Department and Chemist, Respectively, Consolidated Gas & Electric Company, Baltimore

THE steam-vacuum process is standard for treating Southern pine poles. Some trouble has been had in conditioning poles to get them properly seasoned before they are treated. The Consolidated Gas & Electric Company has made tests for treating green poles by the non-pressure process or Boulton process used to treat Douglas fir. The results of these tests are promising

CREOSOTED Southern yellow pine poles have been used for many years and when carefully selected and properly treated with preservative have given satisfactory service. The destruction of untreated (and in some localities of butt-treated) poles by termites justifies careful consideration of a pole timber with relatively thick sapwood that will permit deep penetration of preservative. There are, however, many difficulties encountered in satisfactorily seasoning and creosoting Southern pine poles.

Aside from the necessity of having timber free from injurious defects, poles should be treated with the prescribed amount of preservative to the full depth of the sapwood; seasoning, whether natural or artificial, should not produce excessive checks on circumference or top and poles should not bleed creosote.

The most economical method of treating is by using air-seasoned material, although it is extremely difficult to regulate pole production and treating plant operations in accordance with consumer demand for poles of various lengths and grades. The sapwood of Southern pine is frequently attacked by fungi before the moisture content of the poles has been greatly reduced, resulting in the loss of untreated stock or the possibility of undesirable material being treated.

Some experiments have been conducted to determine the practicability of an initial light preservative treatment of green poles as they are received at treating plants, to be followed by air seasoning in storage, the final treatment to be given as poles are required for shipment.

This method may prove satisfactory and economical, although it requires double handling at treating plants. There is also the possibility that at least some of the poles so treated will not receive desired penetration and absorption of preservative in the final treatment on account of the initial treatment having sealed the wood pores against proper distribution of the creosote oil.

The necessity for treating green or partially air-seasoned poles is therefore obvious. In fact, there are reasons to believe that the best preserved poles will be those treated within 60 days from the stump.

Boiling-in-oil process

The Boulton, or boiling-under-vacuum, process for "conditioning" green wood has been used extensively on the Pacific Coast and is the only satisfactory method developed for seasoning Douglas fir in the treating cylinder. The steam-vacuum process is seldom used as it results in excessive checking of the wood.

This process consists of submerging the wood in creosote under a partial vacuum at temperatures that do not usually exceed 220 deg. F. One distinct advantage of this method over others is the fact that escaping vapors are drawn through a condenser and the amount of moisture reduction in the wood may be measured and the treating cycle regulated accordingly, or until condensation passing from the wood is reduced to a predetermined amount per cubic foot per hour.

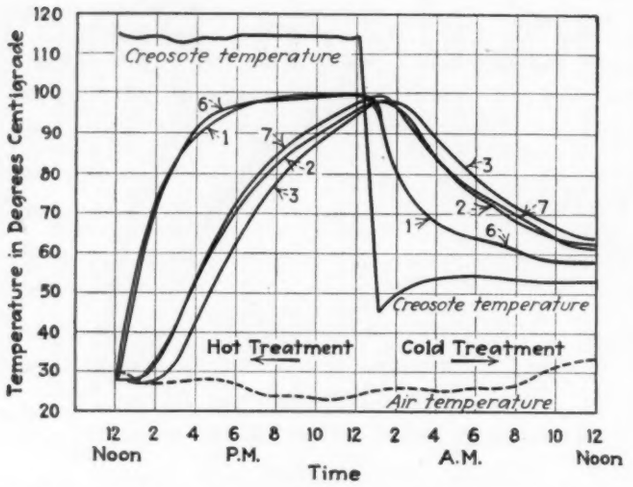
The research committee of the American Wood Preservers' Association reported at the annual meeting in 1928 under the subject of "Boiling Treatments" as follows:

"The fact that seasoning by the Boulton process can be accomplished at considerably lower temperatures than when the steaming and vacuum method is used is an advantage of great importance. Long-continued

**Presented at a recent meeting of the overhead systems committee of N.E.L.A., Baltimore, Md.*

high temperatures not only affect the strength of wood but in the case of a number of commercial species cause severe checking and collapse, notably in such woods as the oaks and refractory conifers like Douglas fir.

"Results indicate that a considerably greater quantity of moisture can be removed from green wood by the boiling process than by steam seasoning. It has been



Heat transfer of green Southern pine pole during hot and cold creosote treatment

Pole No. 3—Diameter, 11.1 in.
No. 1 point 1.25 in. from circumference
No. 2 point 3.5 in. from circumference
No. 3 point 4.9 in. from circumference
No. 6 point 1.4 in. from circumference
No. 7 point 3.5 in. from circumference

shown from experiments that an appreciable amount of moisture is absorbed during the steaming period, and in normal steaming practice only a relatively small quantity of water is ultimately removed. That this should be expected can readily be shown from a theoretical calculation.

"In view of the advantages of the Boulton process over steam seasoning, there is reason to believe that when there is more definite information on the merits of this process for seasoning the various species it will find a field of application in many of the plants which are at present using the steaming process."

As many public utilities and others using Southern pine poles have not urged a boiling-under-vacuum process for seasoning green timber, very few of the commercial treating plants are equipped to perform this service. The tendency of most wood-preserving companies is to modernize their plants and the installation of necessary equipment for boiling under vacuum will surely follow a demand from the consumer for better treated poles.

Tests made at Baltimore

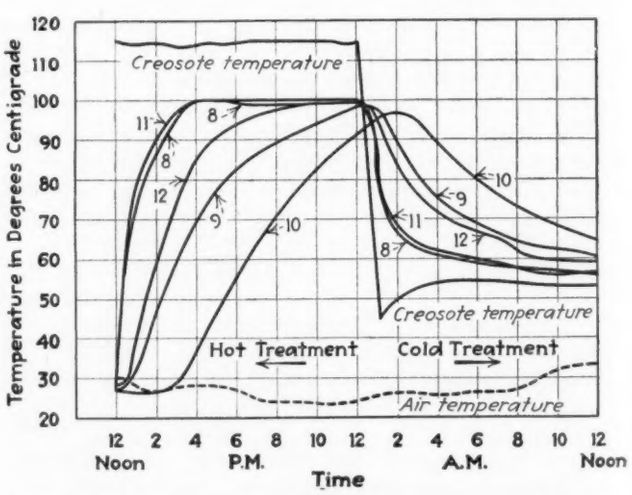
The dissatisfaction of many users of steam-vacuum "conditioned" poles, together with the satisfactory results secured on the Pacific Coast with various processes of boiling in oil, prompted experiments in treating Southern pine poles at the non-pressure treating plant of the Consolidated Gas & Electric Company. Prior to the experimental tests on treating Southern pine poles it had been demonstrated in this plant that penetration and absorption of creosote in sawed lumber and timbers may be controlled to a very large extent by the temperature of the preservative, the length of the treating cycle to be used being determined by the spcies of wood, its dimensions, moisture and sapwood content.

The tank used for treating lumber as well as for these experiments is 4 ft. x 5 ft. 8 in. x 41 ft. long and is equipped with a loose, removable cover. Creosote is heated and cooled by a circulating heater-cooler, which is supplied with steam for heating or water for cooling. The preservative is forced by motor-driven pumps through the heater-cooler from and to the treating tank, thereby maintaining a uniform temperature under positive control throughout the treating tank. The constant circulation of the preservative around the wood helps to remove the film of dead oil and thereby facilitates heat transfer.

These tests, conducted by the electric test department in co-operation with the timber department, are being made to determine the possibilities of treating green Southern pine poles by a boiling-in-oil process, followed by a cool oil treatment at atmospheric pressure. Furthermore, the tests have been undertaken with the belief that if they are reasonably successful in reducing the moisture content, eliminating top and circumference checks and securing satisfactory penetration and absorption of creosote without bleeding, some modification of the Boulton process may prove a solution to the problem in a commercial way.

Specifically, these tests are to cover the following points:

1. The average moisture content of poles as received.
2. Moisture reduction by air seasoning in storage.
3. Heat transfer in poles of various diameters during the boiling-in-oil treatment at different temperatures.
4. Heat loss from poles of various diameters during cool oil treatments.
5. Moisture reduction and creosote penetration during boiling-in-oil treatments.



Heat transfer of green Southern pine pole during hot and cold creosote treatment

Pole No. 2—Diameter, 11.3 in.
No. 8 point 9 in. from circumference
No. 9 point 2.5 in. from circumference
No. 10 point 5.5 in. from circumference
No. 11 point 0.9 in. from circumference
No. 12 point 1.94 in. from circumference

6. Creosote penetration and absorption during cool oil treatment.

7. The effect of boiling in oil at 259 deg. F., comparable with steam at 20 lb. pressure, upon circumference and end checking.

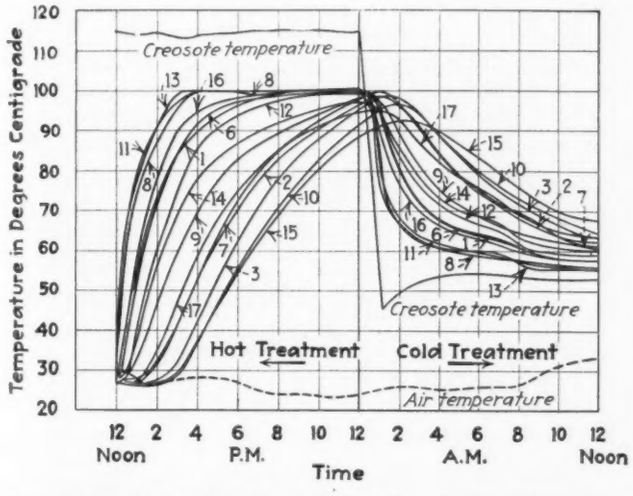
8. The maximum amount of creosote that will be absorbed without bleeding in service.

The points which have been enumerated above may be grouped into three classifications, namely, air-seasoning data, heat-transfer tests and the results of atmospheric pressure-treating process.

Air Seasoning

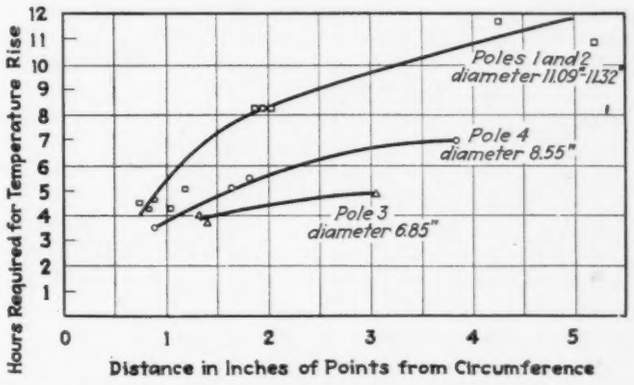
To determine the range of moisture content which could be expected in green Southern pine poles specimens of long-leaf, short-leaf and loblolly pine, ranging from a few pieces to several carloads, have been obtained from Maryland, Virginia, South Carolina and Florida. The moisture content of the samples which have been analyzed has ranged from 36 per cent to 50 per cent of the total weight of the specimen. A number of measurements have been made on full-length poles and on sections of poles to determine the loss of moisture by natural air seasoning in the Baltimore storage yard. In the first month of storage these specimens have lost from 2 to 19 lb. of moisture per cubic foot, depending upon the original moisture content, the season of the year and the diameter of the pole.

A considerable number of experimental treatments on Southern yellow pine poles have been conducted in the non-pressure plant of the Consolidated Gas & Electric Company, using various temperatures and various lengths of treating cycles. In two of these tests the rate of heat transfer of the poles was measured during the entire treating cycle. The purpose of this work was to determine how fast the heat penetrates such poles during the hot treatment and how fast the temperature of the poles drops during the cold treatment. The time required to heat the interior of a pole is of fundamental importance in this process in determining the loss of moisture and the creosote absorption.



Heat transfer of green, dense Southern pine poles during hot and cold creosote treatments

No. 13 point 0.75 in from circumference	Pole No. 4
No. 11 point 0.9 in. from circumference	Pole No. 2
No. 8 point 0.9 in. from circumference	Pole No. 2
No. 1 point 1.25 in. from circumference	Pole No. 3
No. 16 point 1.4 in. from circumference	Pole No. 4
No. 6 point 1.4 in. from circumference	Pole No. 3
No. 12 point 1.94 in. from circumference	Pole No. 2
No. 14 point 2.1 in. from circumference	Pole No. 4
No. 9 point 2.5 in. from circumference	Pole No. 2
No. 17 point 3.3 in. from circumference	Pole No. 4
No. 7 point 3.5 in. from circumference	Pole No. 3
No. 2 point 3.5 in. from circumference	Pole No. 3
No. 3 point 4.9 in. from circumference	Pole No. 3
No. 10 point 5.5 in. from circumference	Pole No. 2
No. 15 point 5.6 in. from circumference	Pole No. 4



Effect of diameter of pole and distance from circumference on time required for points inside the pole to rise from 15 deg. C. to 95 deg. C. with creosote temperature of 124.9. deg. C.

The specimens for the heat-transfer measurements were prepared in the following manner: Sections from green poles of various diameters were cut to a length of 4 ft. 6 in. Holes of ½-in. diameter were drilled at different distances from the circumference to a depth of 24 in. from one end. Copper constantan thermocouples were inserted in the holes and tightly plugged with cotton, the tops of the holes were covered with a high melting asphalt and the pole sections were set upright in the treating tank. During the treatment the poles were immersed in creosote to a depth of 4 ft. Temperature measurements were made at fifteen-minute intervals at each point in the poles by means of a potentiometer. The temperatures at various points in the treating tank and in the outside air were also recorded.

In the first test the poles were treated for twelve hours with creosote at 115 deg. C. (239 deg. F.). At the end of the twelve hours hot treatment the hot creosote was withdrawn and the tank refilled with creosote at 46 deg. C. (115 deg. F.). This creosote was left in the tank for twelve hours without any artificial circulation, cooling or heating. The temperature of the creosote gradually rose to a maximum of 54 deg. C. (129 deg. F.) from the heat given off by the wood.

In the second heat transfer test the treating cycle was essentially the same as in the first test, except that higher temperatures were used. In the hot treatment the average temperature was 124.9 deg. C. (257 deg. F.). At the end of twelve hours the hot creosote was withdrawn and the tank refilled with creosote at 63 deg. C. (145 deg. F.). The temperature gradually rose to a maximum of 71 deg. C. (159 deg. F.). The poles remained in this cool creosote for twelve hours.

The data which have been obtained up to the present time have led to the following generalizations:

1. These heat transfer tests have shown that it is not possible to raise the temperature of the interior of green

pine poles above a maximum temperature of approximately 100 deg. C. (212 deg. F.) in the non-pressure process, although the temperature of the creosote bath is considerably above this temperature. The explanation of this phenomenon is obvious. So long as the wood is sufficiently porous to permit the water vapor in the wood to escape, the vapor pressure in the interior of the poles will not exceed approximately atmospheric pressure. Consequently, the moisture in the interior of the poles will not rise above the temperature of its atmospheric boiling point. The temperature of the various points in poles gradually rises to approximately 100 deg. C. (212 deg. F.) and remains nearly constant until the end of the hot treatment. This phenomenon is of vital importance in the development of any treating process and probably has been overlooked frequently by those in charge of pole-treating operations. In boiling under vacuum the maximum temperature of the interior of the poles will be less than 100 deg. C. (212 deg. F.). In steaming under pressure the interior of the wood will reach the temperature of the steam if the treatment is continued long enough. For instance, when steaming under 20 lb. pressure a maximum temperature of 126 deg. C. (259 deg. F.) can be reached.

2. The time required to raise the temperature of points within the pole is not in direct proportion to their distances from the circumference. The relative time required to heat interior points is less than the ratio of the distances of the points from the circumference.

3. The time required to raise the temperature of the wood at a given distance from the circumference is a function of the diameter of the log. The time required to produce a definite temperature change per inch increases with the diameter of the pole; that is, to produce a certain temperature change more time is required for each inch of the larger specimens than for each inch of the smaller ones. This is due to the decrease in the heating surface per cubic foot of volume with increasing diameters. Consequently, in the full-length treatment of a pole the temperature of a point at a given distance from the circumference will come up to its maximum temperature near the top of the pole more quickly than points at the same distance from the circumference near the butt end of the pole. This will also be true of conditioning by steam or boiling under vacuum.

4. The temperature curves of different points diverge as the temperature rises. This shows that at higher temperatures the time lag of temperature rise of the interior of the poles is greater than at low temperature.

5. Probably the most important fact which this series of tests has shown is the relatively long time which is required to raise the interior of wood to 100 deg. C. (212 deg. F.). This indicates that a relatively long-time hot creosote treatment is required materially to reduce the moisture content of wood by this method.

Results of creosote treatment

The results of the creosote treatment may be summarized as follows:

1. In the two experimental treatments which have just been described creosote penetrations of from 1 in. to 2½ in. were obtained. Treatment should not be considered satisfactory unless all of the sapwood is penetrated.

2. In the last test the creosote absorption ranged from approximately 8 to 12 lb. per cubic foot of wood.

3. The poles came out of the treatment clean and they had not bled after a month of storage.

4. The high temperature of the creosote (127 deg. C. or 260.6 deg. F.) did not cause any more than hair-line checks on the surface of the wood.

5. The average loss in moisture was 7.28 lb. per cubic foot of wood.

Conclusions

Up to the present time a final conclusion has not been reached in regard to the practicability of the non-pressure process for the treatment of green Southern yellow pine poles. However, the results have been sufficiently satisfactory to justify further experimental work. The next step which it is planned to make in this investigation is to determine experimentally the effect of varying lengths of time of hot treatment and of cold treatment upon loss of moisture, the depth of creosote penetration and the amount of creosote absorption.

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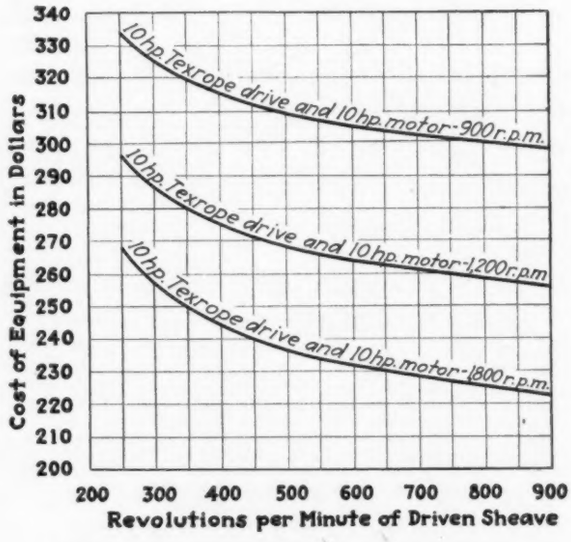
Reducing Motor Drive Costs

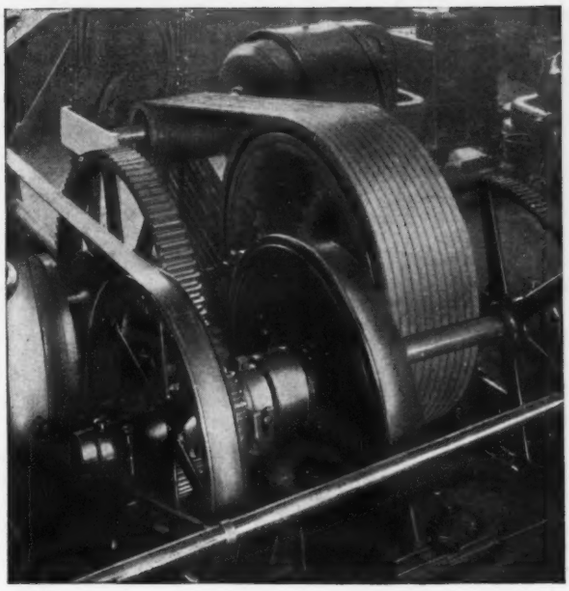
By W. A. MEYER

Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

THE multiple V-belt, which has been introduced for motor drives in recent years, has permitted rather striking savings to be made in the cost of the complete drive to the user. This possible economy is brought out in the accompanying graph, which shows dollar costs for complete drives using 10-hp. motors of 900, 1,200 and 1,800 r.p.m. and the savings that may be made by increasing drive ratios and motor speeds. The large displacements of the three curves indicate these economies in striking manner. They are possible because the price of the higher speed motors drops much more rapidly than the price of the higher ratio drives rises. The result is a significant reduction in total price.



High-ratio multiple V-belt drives show distinct savings



This drive (gear train) formerly needed a three-bearing motor, but substituting the multiple V-belt allowed the use of the standard motor

There are incidental advantages in the use of high-speed as against low-speed motors which do not appear on the graph and which conceivably might add appreciably to the total economy. These have to do with the inherently better electrical characteristics of high-speed alternating-current motors, such as improved starting torque, higher efficiency and higher power factor. Another consideration for economy is the fact, shown in the accompanying illustration, that the multiple V-belt, on account of its shape and large tractive area, requires comparatively low belt tensions. This results in distinctly lessened bearing pressures on the driving and driven shafts and in many instances permits the use of two bearing motors in situations that otherwise would require a third bearing at the end of the drive pulley.

Co-operative Power Supply Will Serve Cambridge, Mass.

By HARDING U. GREENE

Assistant General Manager Cambridge Electric Light Company

PLANT changes which will cost about $1,000,000 will be completed before 1931 by the Cambridge (Mass.) Electric Light Company, which has been making a thorough study for the past two years of the power requirements of this educational and industrial center. The city of Cambridge is located in the midst of the territory of the Boston Edison Company and about 15 per cent of its power supply has been purchased from the Edison company, the balance being generated in the Cambridge company's 20,000-kw. plant located on the Charles River about ½ mile from Harvard University.

In 1929 the university decided to tear down its heating plant and arranged to buy steam at 100-lb. pressure from the Cambridge company's plant. This year this steam for heating will amount to about 500,000,000 lb. and require a boiler capacity at peak hours of about 5,000 b.h.p. To supply this steam and the electrical requirements of the university and the city various possible plans were made up in detail. About twelve various plans were considered. Also, negotiations were carried on with the Edison company, and the plan approved included:

1. Replacing part of present power plant with up-to-date equipment and an increase in boiler capacity.
2. Co-operative operation of the generating equipment of the plant with the Boston Edison's plant to give the best system economy (considering the Edison plant and the Cambridge plant all as one system).
3. Four hundred-pound steam for new boilers, and a back-pressure turbine (400 lb. to 100 lb.) for Harvard steam supply.

The plans which were worked out projected the loads, outputs and power costs for fifteen years into the future and included various methods of supply from an entirely new power plant in another part of Cambridge to the purchase of all power.

Industrial User Extols Virtues of Electric Steel

"FOR continuous uniformity and control of distortion the electric furnace steels seem to give better results than the open-hearth steels. It is our experience that the variation in properties of one part of an open-hearth heat to another is greater than the variation from one electric furnace heat to another. This is particularly true where an effort is made to control the grain size to obtain uniform results in machining and distortion.

"Tests made by running an open-hearth steel against electric furnace steels of the same analysis indicate that it is impossible to control or predict the change in bearings with the open-hearth steel, whereas this has been found to be quite feasible commercially with electric furnace steel.

"Inasmuch as the difference in price between the electric furnace steel as made by the large producers and the better grades of open-hearth steel is relatively small, it will be found that the slight difference in price is not enough to offset the advantages of the uniformity of the electric furnace steel."

The foregoing statement was embodied in an address presented recently before the American Society for Steel Treating by H. W. McQuaid and O. W. McMullan, Timken-Detroit Axle Company.

READERS' FORUM

72 Towns Include Welding in Building Code

To the Editor of the ELECTRICAL WORLD:

Following is a list of cities and towns which have included welding in their building codes:

Adopted Pacific Coast Building Officials' Conference Code

Arizona
- Prescott
- Tuscon
- Yuma

California
- Alameda
- Alhambra
- Alturas
- Anaheim
- Bell
- Berkeley
- Brawley
- Claremont
- Compton
- Corcoran
- Coronado
- El Monte
- Fontana
- Fresno
- Fullerton
- Laguna Beach
- La Habra
- Livermore
- Madera
- Martinez
- Monrovia
- Monterey Park
- Oceanside
- Oxnard

California Cont'd.
- Ontario
- Pasadena
- Piedmont
- Pittsburg
- Pomona
- Redlands
- Riverbank
- Sacramento
- San Bernardino
- San Anselmo
- San Fernando
- San Jose
- San Leandro
- San Rafael
- Santa Monica
- Seal Beach
- Sebastopol
- South San Francisco
- Tulare
- Tujunga
- Turlock
- Tustin
- Ukiah
- Upland
- Visalia
- Walnut Creek
- Watsonville
- Willow Glen

Louisiana
- Monroe
- Shreveport

Montana
- Helena

Nevada
- Las Vegas

New Mexico
- Albuquerque

North Dakota
- Grand Forks

Oregon
- Cottage Grove
- Eugene
- Klamath Falls
- Salem

Texas
- Corpus Christi
- Dallas

Washington
- Ellensburg
- Kelso
- Olympia

Adopted American Welding Society Code

Massachusetts—Pittsfield, Lynn

Texas—Dallas

FRANK P. McKIBBEN,
Consulting Engineer.

General Electric Company,
Black Gap, Pa.

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Declares Small, Compact Breakers Now Available

To the Editor of the ELECTRICAL WORLD:

In your editorial of March 29 entitled "New Starters Needed for Small Motors" it is stated that:

"Several years ago Europe took the lead in developing some compact automatic toggle switches for lighting circuits, and these began to penetrate the American market."

Quite right, the first small compact branch circuit, circuit breaker came upon the market in 1919, eleven years ago.

The idea to replace fuses with circuit breakers quickly took hold abroad and now circuit breakers are being used almost universally upon branch circuits and meter service entrances.

The editorial further states:

"There is a very satisfactory American starter upon the market for larger motors, but for *small* across-the-line motors—and these motors are becoming very popular for factory use—there is yet nothing to compare with the various European devices, some of which are beginning to show up on the American market.

"What is needed is a small, manually operated, fuseless switch, either oil or air, having both time-delay overload, so as not to trip on starting current, and a separate instantaneous, short-circuit protection.

". . . and it is hoped that such starters will soon be made available to the American factory owner for the smaller motors."

There is available right now a small air circuit breaker and also a small oil circuit breaker with the qualifications expressed in the editorial.

Both of these devices give complete short-circuit protection, and therefore do not require that fuses be added, as in the case of a magnetic starter.

BRUNO H. AHLERS.

Woodhaven, L. I., N. Y.

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Night Football Advantageous in Southwest

To the Editor of the ELECTRICAL WORLD:

The article entitled "Night Football Is Practical," by W. C. Pearce, as published in the issue of March 8, was of considerable interest to me.

Here at the Oklahoma Agricultural and Mechanical College, in Stillwater, night football was introduced last fall. The increase in attendance at the first game, visibility of all the plays such as passes, punts, etc., its increase in popularity with succeeding games, etc., were similar to that indicated by Mr. Pearce in his article. In the Southwest night football has the additional advantage of having the players in the game during the evening rather than in the heat of the day. It also made it possible for many alumnæ to attend who could not have come otherwise.

The lighting equipment consists of twenty units of the "New Giant Cahill Duplex Projector," each provided with two 1,000-watt P.S. 52 clear "Mazda" bulbs. These units were placed on 55-ft. poles, set about 10 ft. from the side-lines and about 3 ft. inside of the inside curb of the running track that surrounds the playing field. Six poles were spaced equally on each side of the field, the end poles being placed within a few feet of the goal lines. Each of these poles, with the exception of the two center ones, placed one on each side of the 50-yd. line, carry two "Duplex Projectors," while the center ones each carry one projector. Power was transmitted to the field at 2,300 volts, where it was reduced to a 230-115-volt, three-wire system through four 10-kva. transformers. These transformers were placed on the poles in symmetrical locations relative to the field, each supplying the projectors on three poles.

Plans are now under consideration for lighting tennis courts for night practice. Due to the winds prevailing during the day, and the relative absence of them after sunset, the players believe that they can practice to a greater advantage on lighted courts than they can during the day.

A. NASTER,
Head of Electrical Engineering Department.

Oklahoma Agricultural and Mechanical College,
Stillwater, Okla.

Men of the Industry

CHARLES C. EGBERT, consulting engineer of Niagara Falls, N. Y., has been appointed by Governor Roosevelt to succeed Paul A. Schoellkopf as a member of the Commission for Niagara State Reservation.

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LANDON K. THORNE, president of Bonbright & Company and of the American Superpower Corporation, has been elected a director of the Niagara Hudson Power Corporation. He is also a director of the Commonwealth & Southern Corporation, the United Light & Power Company, the United Corporation and affiliated utility companies.

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E. D. KILBURN, vice-president and general sales manager of the Westinghouse Electric & Manufacturing Company, has resigned. Announcement is also made that W. S. RUGG, vice-president in charge of engineering, will continue to hold the same position and in addition assume control of the sales policies of the company. S. M. KINTNER, manager of research engineering, becomes assistant to Vice-President Rugg on engineering supervision.

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PRICE CAMPBELL, formerly executive vice-president of the West Texas Utilities Company, was elected president of the company at a meeting of the board of directors. Mr. Campbell succeeds the late George W. Fry, under whom he served as executive officer since the organization of the West Texas company. EARL R. HOPPE succeeds Mr. Campbell as vice-president, retaining the title of general superintendent in charge of operations. Mr. Hoppe has been with the company for many years.

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Dr. FRANKLIN S. IRBY and KEITH HENNEY, specialists in vacuum tube applications, have joined the editorial staff of the new McGraw-Hill publication, *Electronics*, which is headed by O. H. Caldwell, former United States Radio Commissioner, and for many years associated with the McGraw-Hill publications ELECTRICAL WORLD, *Electrical Merchandising* and *Radio Retailing*. Mr. Irby was formerly lieutenant-commander in the United States Navy, having graduated from Annapolis in 1917. After one year at the post-graduate school in Annapolis, he continued his post-graduate work at the University of Chicago, receiving his M. S. degree in 1923 and his Ph.D. in 1924. For the past two years he has been concentrating on sound picture work as recording engineer for Electrical Research Products, Inc. Keith Henney, who is widely known as an author and authority on electronic tubes and radio, received his master's degree from Harvard in radio communication and physics in 1925, following post-graduate work at Harvard from 1921 to 1925. Since 1925 he has been director of the *Laboratory of Radio Broadcast* magazine, published by Doubleday-Doran Company.

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Thurlow and Polk Named Vice-Presidents of Allied Engineers

OSCAR G. THURLOW, chief engineer of the Alabama Power Company, and A. C. POLK, president of the Dixie Construction Company, have been named vice-presidents of Allied Engineers, Inc., recently organized with headquarters in New York. Mr. Thurlow entered the service of Alabama Power Company as designing engineer on the construction of its Lay Dam project in 1912 and was named chief engineer in 1914, which position he has since held, with supervision over all engineering and construction activities. In 1926 he was made vice-president and a director of the company and the scope of his duties extended to include construction and engineering of a number of affiliated companies in the South. His achievements in the design of power dams, including the patented Thurlow back-water suppressor built into Mitchell Dam on the Coosa, won for him in 1927 the degree of doctor of science from the University of Alabama and the award of the Potts medal by the Franklin Institute at Philadelphia. Mr. Thurlow will retain his headquarters in Birmingham, directing the activities of Allied Engineers in the South from that office.

O. G. Thurlow

Mr. Polk became associated with the power company's organization as resident engineer for the Lock 12 development. On completion of the dam, he returned to New York and in 1923 again became connected with the power company as construction manager. He was later made president of Dixie Construction Company, an affiliated construction organization operating in several Southern states. The power properties constructed under his direction include Martin, Jordan, Lay, Upper and Lower Tallassee hydro dams and the Gorgas No. 2 steam plant in Alabama, steam plants in Mobile and Charleston, the Furman Shoals hydro plant in Georgia, scores of primary and customer substations and hundreds of miles of power lines throughout the South. Mr. Polk's headquarters will be in New York.

A. C. Polk

H. C. Sutton in Havana

H. CRAIG SUTTON, formerly electrical engineer of the United Gas Improvement Company, has been appointed chief engineer of the Cia Cubana de Electricidad (Cuban Electric Company), Havana, Cuba, a subsidiary of the

American & Foreign Power Company. A graduate of Cornell University, Mr. Sutton had been affiliated with the United Gas Improvement Company since 1913. He had been assistant to the electrical engineer until 1927, when he was named electrical engineer. Previously he had been with the General Electric Company and the Oregon Power Company.

In the course of his career Mr. Sutton has been active in association work, having served as a member of various committees of the National Electric Light Association, the American Institute of Electrical Engineers and the American Gas Association. At the present time he is a member of the power transmission and distribution committee of the A.I.E.E., a counsellor of the overhead systems committee of the N.E.L.A. and a member of the joint committee of the National Electrical Manufacturers' Association and the National Electric Light Association on the standardization of primary voltages.

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LOUIS S. LEAVITT, who has been manager of the Lowell (Mass.) Electric Light Corporation since July 1 last, has been appointed assistant to the vice-president and general manager of the Worcester (Mass.) Electric Light Company. A biographical sketch of Mr. Leavitt appeared in the ELECTRICAL WORLD of July 13, 1929, page 84. His career includes varied service in electrical lines in the Far West and Orient, and for three years he was associated with *Electric Light and Power*, becoming managing editor of that publication in July, 1927.

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GUY W. FALLER, a vice-president of the Public Service Company of Colorado, has resigned to become manager of the Henry L. Doherty & Company securities department at Denver. Mr. Faller was appointed to fill the vacancy caused by retirement of E. Salisbury Smith, resigned. Since 1903, when Mr. Faller relinquished his commission in the United States Navy to affiliate himself with the Madison Gas & Electric Company, he has been a member of the Cities Service personnel. He was identified with the old Denver Gas & Electric Light Company, now Public Service Company of Colorado, from 1905 to 1913 and returned to Colorado from Amarillo, Tex., in 1923 to occupy the position he has since held. For several years he has directed Public Service Company of Colorado customer-ownership campaigns.

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J. D. Ross has been reappointed superintendent of municipal lighting for the city of Seattle, Wash., by Mayor Frank Edwards, recently returned to office.

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OBITUARY

Dr. Thomas Addison

DR. THOMAS ADDISON, who served for 31 years as Pacific Coast manager of the General Electric Company, with headquarters in San Francisco, until his retirement in 1923, died suddenly in Berkeley, Calif., April 8 at the age of 76. Educated originally as a physician, Dr. Addison was graduated from Bellevue Medical College, New York, in 1877, but after eight years gave up his

practice to enter the employ of the United States Electric Company of Chicago. In 1888 he became an apparatus salesman for the Thomson-Houston Company in Chicago, and when in 1890 the Western branch of the company was reorganized, he was sent to San Francisco as local manager. Two years later he become Pacific Coast manager of the General Electric Company.

When Dr. Addison went to the Pacific Coast the first electric railway of California was under construction at San Jose and he had charge of the installation of the Thomson-Houston equipment. From that beginning, the company, which handled at first generating equipment and motors, grew rapidly under Dr. Addison's guidance and became an important factor in the development of irrigation and industry. Electricity was put to many new uses, such as the pumping of water and its application in the oil fields.

After 33 years of distinguished service, Dr. Addison retired September 1, 1923. So intimately had he been connected with the electrical development of the Pacific Coast that his name will stand close to the top of the list of those pioneers whose efforts laid the foundation of the electrical industry.

Dr. Addison played an active part in the educational and civic life on the Pacific Coast and at one time served as president of the board of trustees of the Pacific School of Religion in Berkeley, and also was president of the board of trustees of the normal school in San Jose, now the State Teachers' College.

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JOHN J. BORGER, superintendent of electrical distribution for the Springfield (Mo.) Gas & Electric Company, died April 9. Mr. Borger had been identified with the Springfield properties for a number of years. He was a member of the American Institute of Electrical Engineers.

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BRUCE L. ROBINSON, president Bruce Robinson Electric Company of Alberta and British Columbia, died suddenly at Vancouver, B. C., recently. Mr. Robinson was visiting the Vancouver branch of his organization en route from California, and passed away two days after his arrival in the western Canadian city. He was a past-president of Calgary Board of Trade.

Financial and Statistical News

EASY money conditions have caused the uninterrupted advance in the stock market, but judging from the earnings statements for the first quarter business has not improved sufficiently to warrant the gain in market prices. This uneasiness was reflected in the market during the past week, when prices were quite irregular.

——UTILITIES MARKET WAS CHARACTERIZED by a mixture of losses and gains. American Water Works & Electric, North American and Cities Service lost ground, while American & Foreign Power, American Gas & Electric and Electric Bond & Share reported gains.

——THE BOND MARKET, which advanced conspicuously during the month of March, is still holding firm.

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Sales Increasing Faster than Customers

THE GAIN IN NUMBER of meters on the New York Edison System in 1929 was 68,485. The greatest gain was in Brooklyn, with 23,619. In Queens the increase was 20,550, in Yonkers 2,921 and in Manhattan and Bronx 21,395. The total number at the end of the year was 2,188,121.

Comparison of this 3.2 per cent gain with the increase of 7.6 per cent in energy sales for the same period shows that the increase in meters is not an accurate index to growth in congested areas like Manhattan, where several six-story buildings containing a number of meters may be replaced by a skyscraper with fewer meters but greatly increased consumption of current. Many new buildings use ten to twenty times the current their predecessors on the same sites used.

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Britain Lagging Behind in Electricity Production

FIGURES WHICH HAVE just been completed showing the production of electricity in the United Kingdom in 1929 bring to light one or two disquieting facts. They show that the rate of progress in Britain was distinctly unsatisfactory compared with America and Germany. In Britain production increased rfom 14,929,000,000 to 16,300,000,000 units, or 9 per cent. The American figures rose from 114,150,000,000 to 126,704,000,000 units, a level over eight times as high as Britain's and 11 per cent above that of 1928. Germany's production rose from 28,110,000,000 units to 33,000,000,000 units, double Britain's production, and 17.5 per cent higher than in 1928.

These figures afford sufficient evidence that Britain is lagging behind the great powers in electricity production. On a per capita basis Britain consumes about 30 per cent less than Germany and about 60 per cent less than America. One significant fact about the figures is that production in private industrial plants in Britain increased much more rapidly than in public supply undertakings.

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Niagara Hudson Acquires Northeastern Power

STOCKHOLDERS OF THE Northeastern Power Corporation have approved the sale of all assets of the company to the Niagara Hudson Power Corporation. With the Northeastern and Mohawk Hudson elimination ratified, the subsidiary holding companies still in existence are the Buffalo, Niagara & Eastern Power Corporation, the St. Lawrence Securities Corporation, the Eastern Gas & Electric Securities Company, the Frontier Corporation and the Hudson Valley Fuel Corporation. The operating companies, formerly controlled by Mohawk Hudson and Northeastern, are now directly owned by Niagara Hudson Power.

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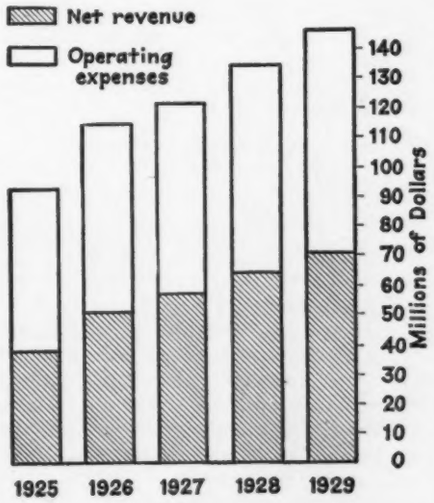
North American Company Net Gain 10.8 per Cent

THE North American system closed the year showing somewhat better than the average increase in gross earnings, namely, 9 per cent. The total for the year was $147,779,869. Operating costs were held well in line, rising only 7.4 per cent, which made possible an increase in net operating revenue of 10.8 per cent, which is better than the average for the industry. The operating ratio is also slightly reduced to marginally below 52, against 52.49 for 1928. Gross revenue of the system has approximately doubled since 1923.



Gross revenue shows consistent growth

The officers of the company followed their usual policy of making ample appropriations for depreciation. Appropriations for depreciation reserves amounted to 10.57 per cent of gross earnings and were equivalent to $2.91 per share on the average number of shares outstanding during the year. After deducting depreciation and all other reserves the balance for dividends and surplus amounted to $28,806,824.

The balance of $26,986,790 after all preferred dividends is an increase of 19.5 per cent over the previous year and is equivalent to $5.03 per share on the average number of shares of North American common stock outstanding during the year, compared with $4.68 per share on the average number of shares outstanding during 1928. Since

the company has consistently pursued the policy of paying stock dividends rather than cash dividends since 1923, the entire balance of $26,986,790 was made available for investment in the business. At the end of the year reserves amounted to $113,690,322. Undivided profits were $96,387,457.

Properties well diversified

One of the outstanding features of the North American System is the diversification of the properties. This diversification has stood the organization well during the period of depression and places the company in a strong position to increase its business growth during seasonal or temporary recessions peculiar to a single locality or industry

Despite the depressed status of business during the latter part of 1929 the company was able to close the year with a substantial gain both in electrical and in gas business. Electric output amounted to 6,772,637,073 kw.-hr., which is an increase of approximately 11 per cent over the output for 1928. Total installed electric generating capacity of power plants amounted to 1,988,202 kw. at the end of the year, which is an increase of approximately 10 per cent. Of this total, incidentally, steam accounted for 77.57 per cent and hydro-electric for 22.43 per cent. There were 1,216,428 customers receiving electric service at the end of the year, and steam sales auxiliary to such electric service aggregated 5,306,705,100 lb. to 2,591 customers.

Relative to the payment of dividends in stock, the company says in its annual report: "Your company's policy of paying dividends on its common stock at the quarterly rate of 2½ per cent (1/40 of a share) is now in its seventh year. In 1929, as in previous years, a large majority of stockholders retained their dividend stock; their wisdom of thus increasing their holdings without additional cash outlay has been again confirmed by the increase of net earnings at a rate greater than the rate of increase in the shares of common stock. From April 1, 1923, to December 31, 1929, common stock increased 110.42 per cent on account of stock dividends and 38.01 per cent on account of stock issued for cash and for property, a total increase of 148.43 per cent, while during the same period the balance for common stock dividends increased 299.38 per cent. In addition to the company's regular practice of acting upon requests for stockholders who wish to add to or dispose of their dividend stock, arrangements were made during the past year to act also for those who wish the company to hold for their account fractional script to be assembled and exchanged for stock certificates for full shares."

Recent acquisitions of the company on the Pacific Coast have been discussed in a recent issue.

NEW CAPITAL ISSUES

American Electric Power Corporation
Convertible gold debentures.
Amount—$2,000,000.
Price—94½ and accrued interest, to yield about 6.45 per cent.
Feature—These debentures are convertible at the option of the holder into the $7 preferred stock of the corporation.

American Electric Power Corporation owns or controls through subsidiaries a group of properties which supply electric power and light and manufactured or natural gas service in more than 281 communities.

Maryland Light & Power Company
First mortgage gold bonds, series A.
Amount—$1,000,000.
Price—96 and interest, yielding approximately 5.85 per cent.
Security—These bonds will constitute the only funded debt of the company to be outstanding upon completion of present financing and will be secured by a direct first mortgage on the fixed properties of the company.

Maryland Light & Power Company is subsidiary of Empire Public Service Corporation. Organized in December, 1929, it will acquire properties now furnishing electric light and power to 64 communities in the State of Maryland having a combined population of approximately 40,000.

Consumers Power Company
First lien and unifying mortgage gold bonds.
Amount—$20,000,000.
Price—97 and accrued interest, to yield about 4.70 per cent.

Consumers Power Company owns and operates extensive systems of electric light and power and gas properties in Michigan, serving one of the most important industrial sections of the country. The company is controlled through ownership of all its common stock by the Commonwealth & Southern Corporation.

Texas Power & Light Company
First and refunding mortgage gold bonds.
Amount—$4,000,000.
Price—98½ and interest, yielding over 5.10 per cent.

Texas Power & Light Company owns and operates one of the largest electric transmission systems in the South, supplying electric power and light service directly or indirectly to 286 communities in the State of Texas.

Berlin City Electric Company
Twenty-five-year debentures.
Amount—$15,000,000.
Price—90½ and interest, to yield about 6.80 per cent.
Feature—These debentures are listed on the Boston Stock Exchange. A substantial amount of these securities has been withdrawn for offering in Europe.

The city of Berlin, which owns all of the company's capital stock, has leased its electric properties to the company under an agreement, extending beyond the maturity of these debentures, empowering the company to fix rates for the sale of electricity adequate to cover all operating expenses, interest and amortization of loans, depreciation and other proper reserves, and providing that upon termination thereof the city shall assume all obligations of the company, including interest and amortization of loans.

Calgary Power Company, Ltd.
First mortgage gold bonds.
Amount—$8,000,000.
Price—94 and accrued interest, to yield about 5.40 per cent.
Purpose—Proceeds will be used to fund expenditures on the Ghost power development and for retirement of the first mortgage bonds now outstanding.

Calgary Power Company has supplied power in bulk to the city of Calgary for the past nineteen years. The present installed capacity of the hydro-electric plants of the company comprises more than 98 per cent of the developed water power in Alberta, and its transmission system serves the most thickly populated section of the province, from a point 50 miles north of Edmonton to the United States boundary, a distance of about 450 miles. The company has in operation three hydro-electric stations on the Bow River.

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NEWS BRIEFS

Stockholders of the American Light & Traction Company will vote May 5 on a plan which involves changing the $100 par common and preferred stock into four shares of $25 par.

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Standard Management and Operating Corporation has been organized with offices in San Francisco to direct and supervise the operation and development of public utilities and industrial establishments. It also engages in engineering and construction work, specializing in gas and electric systems; conducts investigations, makes appraisals and prepares reports on problems of management.

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Pacific Gas & Electric Company has announced the election of two new directors, John P. Coghlan, second vice-president and assistant to the president, and Charles L. Barrett, assistant secretary, to succeed John A. McCandless, deceased, and John S. Drum, respectively.

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Stockholders of Consolidated Gas, Electric Light & Power Company of Baltimore at the annual meeting approved the increase in authorized comman stock from 1,200,000 to 2,000,000 shares and the preferred by an issue of 200,000 additional series A 5 per cent shares.

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Illinois Power & Light Corporation has increased the common stock from 600,000 shares without par value to 800,000.

General Manufacturing Continues Under Last Year

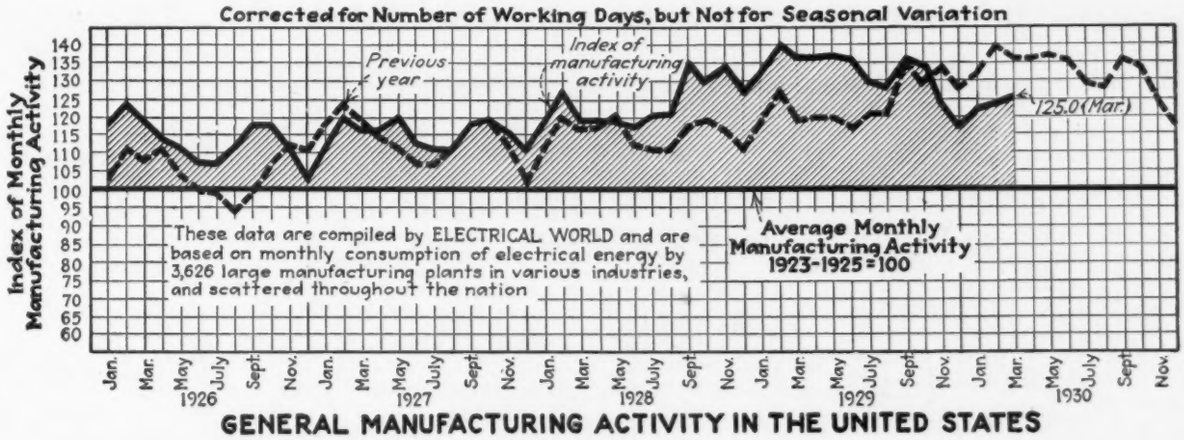
THE closing month of the first quarter witnessed a slight increase in the rate of general manufacturing operations, gaged by the consumption of electrical energy by about 3,800 manufacturing plants reporting to the ELECTRICAL WORLD. The March operations, however, were only 1.2 per cent over those of February and 2.6 per cent above those of January. The average rate of manufacturing operations for the first quarter was 9.4 per cent under the same period last year, and the quarter closed with a rate of operations 7.9 per cent under the same time last year. During the quarter manufacturing operations were generally conducted on cautious and conservative schedules, only a few industrial groups witnessing the increases normal during this quarter.

While manufacturing in general during the first quarter was materially under that of last year, yet several of the industrial groups witnessed operations above those of the first quarter of 1929. Shipbuilding led with an increase over 1929 of 22.8 per cent, paper and pulp 5.0 per cent, food products 5.0 per cent, chemical products 4.6 per cent and rubber products 1.4 per cent.

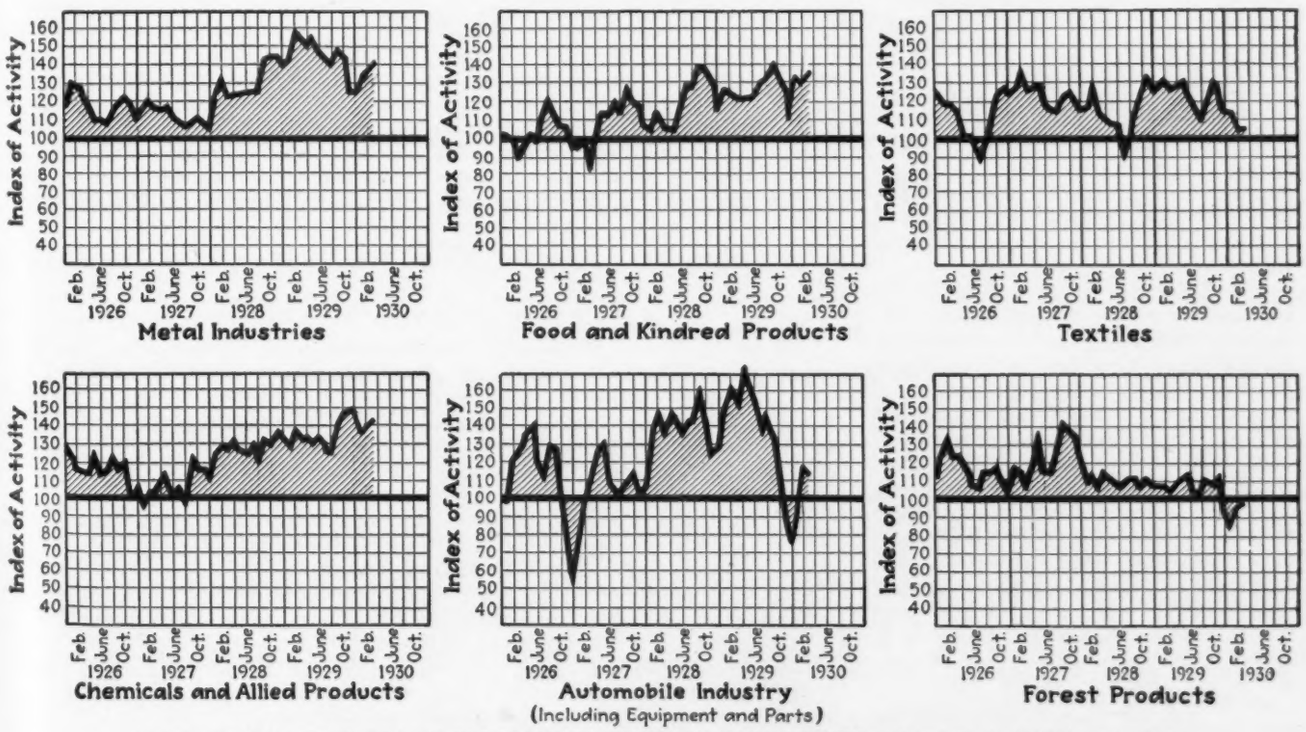
How Current Manufacturing Compares with that of Other Periods

(Nation as a Whole)

Industrial Group	March, 1930, and February, 1930	March, 1930, and March, 1929	First Quarter, 1930, and First Quarter, 1929
All	+1.2	—7.9	—9.4
Chemicals	+2.2	+7.3	+4.6
Food	+4.5	+10.5	+5.0
Steel plants	—0.5	—11.2	—10.2
Metals	+5.2	—9.4	—10.6
Leather	—2.8	—10.0	—9.3
Lumber	+2.8	—6.6	—12.4
Paper	+1.7	+8.7	+5.0
Rubber	—27.0	—13.0	+1.4
Shipbuilding	—2.4	+22.8	+22.8
Stone	+5.1	—11.2	—14.3
Textiles	Same	—18.3	—18.0
Automobiles	—2.9	—26.7	—29.2


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
125.0 (Mar.)
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Copper Drops to Fourteen Cents

THE first birthday anniversary of 18-cent copper was chosen by the copper producers for the event that has been rumored and prophesied for months—a drop in price. The New York market base price broke from 18 to 14 cents on Tuesday, it being felt that no half-way measure would be effective. This drop apparently resulted from a failure of copper producers to control the market situation. The large producers made a valiant effort to curtail production to accord with demand, and actually the world production was cut about 25 per cent in the year, but consumption dropped off considerably more than this and an unusual percentage of scrap appeared. Demand tapered off both in the United States and abroad, partly owing to the industrial depression and partly because many electrification projects, especially in foreign countries, were postponed because of the high price of copper, or aluminum was substituted.

In the decision to reduce the price to 14.30 cents for export and 14 cents for Connecticut deliveries in the domestic market to the end of July there is nothing to indicate that the producers are going back to the unbridled competition of the old days, and the violence of the decline would indicate that no further concession is likely in the immediate future.

To the electrical industry this decrease in copper prices means an enormous saving. It should stimulate copper purchases greatly and increase utility and industrial electrical construction.

The difference of 4 cents a pound amounts to nearly $40,000,000 a year for the electrical industry. According to the *Year Book* of the American Bureau of Metal Statistics, it is estimated that the consumption of copper in tons in 1928, the latest year for which figures have been published, was about as follows: Electrical manufactures, 213,000; light and power lines, 115,000; trolley wire, 6,300; steam railways electrified, 800; telephones and telegraphs, 119,000; radio receiving sets, 5,100; electric refrigerators, 13,200; washing machines, 2,600. The two last items are exclusive of motors, which are contained in the first item.

At $80 a ton this is equivalent to $28,008,000 for machinery and distribution of power, $9,928,000 for the two items representing communication and another $1,264,000 for the two household appliances mentioned. A change in cost of materials is almost inevitably accompanied by corresponding changes in overhead and in selling expenses, so that the fluctuation in cost of the finished product is likely to exceed considerably the change computed on the price of the raw material only. If that occurs in the present instance the price to the consumers of the product will be reduced by much more than the estimated $40,000,000, with, presumably, an appreciable stimulation of buying.

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Westinghouse Switchgear for Detroit Pumping Plant

THE CONTRACT for the electric switching equipment for the pumping and power plants of the Springwells station, city of Detroit, has been awarded to the Westinghouse Electric & Manufacturing Company. This station will be the largest single pumping station ever built and it will be controlled by Westinghouse switchgear throughout. The control includes about 160 steel switchboard panels, 75 current-limiting reactors for power bus and motor starting, 27 steel circuit breaker cubicles and 53 metal-clad switchgear units. In addition, there are included three 300-kw. and three 50-kw. motor-generator sets for excitation and auxiliary service and all field rheostats and induction motor secondary control. There will also be two Westinghouse stokers installed in the station.

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General Electric Issues Quarterly Statement

ORDERS RECEIVED BY THE General Electric Company for the first quarter of 1930 amounted to $90,397,731, compared with $101,365,208 for the corresponding three months of last year, Gerard Swope, president, announced at the recent annual meeting of stockholders.

	1930	1929
Net sales billed	$91,205,732	$83,385,015
Less: Cost of sales billed, including operating, maintenance and depreciation charges, reserves and provision for all taxes	80,590,320	73,206,207
Net income from sales	$10,615,411	$10,178,808
Other income, less interest paid and sundry charges	4,427,110	4,327,177
Profit available for dividends	$15,042,521	$14,505,986
Less: Cash dividends on special stock	643,731	643,688
Profit available for dividends on common stock (28,845,927 36/100 shares issued)	$14,398,790	$13,862,298

As a result of the transfer of radio receiving set and tube business, outlined in the 1929 annual report, orders received, sales billed and net income from sales in 1930 will not include radio sets and tubes, but income received will be included in "other income."

Sales billed for the first three months of 1930 amounted to $91,205,732, com-

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DELINQUENT ELECTRICAL ACCOUNTS

National Electrical Credit Association

Number of Accounts Reported

Division	March 1929	March 1930	Per Cent Increase or Decrease	Three Months 1929	Three Months 1930	Per Cent Increase or Decrease
New York	268	335	+25	683	991	+45
Middle and Southern Atlantic	176	204	+15.9	441	627	+42.2
New England	167	145	—13.2	458	385	—15.9
Central	740	842	+13.8	1,934	2,474	+27.9
Total	1,351	1,526	+12.9	3,516	4,477	+27.3

Total Amounts Reported

	March 1929	March 1930	Per Cent Increase or Decrease	Three Months 1929	Three Months 1930	Per Cent Increase or Decrease
New York	$64,073	$54,058	—15.6	$134,252	$185,697	+38.3
Middle and Southern Atlantic	24,576	33,720	+37.2	62,756	92,342	+47.2
New England	23,468	21,448	— 8.6	61,850	62,667	+ 1.3
Central	95,779	113,822	+18.8	233,633	355,946	+52.4
Total	$207,896	$223,048	+ 7.3	$492,491	$696,652	+41.5

pared with $83,385,015 for the corresponding period last year. Profit available for dividends on common stock for the first quarter of 1930 was $14,398,791, compared with $13,862,298 for the same three months last year. Profit available for common stock for the quarter is equivalent to 50 cents per share in 1930, compared with 48 cents in 1929 on the shares now outstanding.

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Has Faith in Business Uptrend

"WE ARE firm in the faith, especially in the electrical industry, that the needs of 125,000,000 people, increasing in number and demands, will keep our industry and commerce constantly on the up trend," said Gerard Swope, president of the General Electric Company, before the Boston Chamber of Commerce last week. "As a single barometer of better things," said the speaker, "the use of electricity in the United States in January and February was about 4 per cent ahead of the same months last year. The percentage increase is less, but the total use is greater." Mr. Swope paid a tribute to the enterprise of the Boston Edison Company's pioneer work in high-pressure steam generators at the Edgar station and to the progressiveness of the Hartford Electric Light Company in mercury boiler development, pointing out that these steps toward increased efficiency in production of electricity are examples of what is taking place all through the electrical industry, tending to decrease costs and which mean and have meant lower prices to consumers, wider application and greater consumption of electricity.

General Electric in New England

"In the last eight years the General Electric Company has increased its investment in manufacturing in New England 40 per cent; its manufactured output has increased 100 per cent. These two figures show the increased efficiency of operation, which is true among manufacturing companies in general. In the same length of time the sales of the company in New England increased 90 per cent. The sales of our apparatus, therefore, did not increase quite so rapidly as the production, which, of course, meant production for other parts of the United States, which, incidentally, shows the advantage to a section of a factory with national distribution.

"Another matter of especial interest is the fact that the General Electric Company has spent more in increasing its permanent investments here, such as buildings and manufacturing facilities, and spends more each year in annual payroll in New England than its annual sales in this district. It may also be of interest to know that though in New England we are not employing so many people today as we were at the peak of production last fall, seasonal variations must be considered and we are employing more people today in New England than we were at the same time a year ago.

"The above is a brief picture of the General Electric Company's activities

in New England. Some of our best factories, our best workmen and management are here. Indeed, I often marvel that some of our factories located in your midst, with no patent protection—indeed, putting out in many cases simple, highly competitive products, with good management, high efficiency, good common sense, New England ingenuity and Yankee shrewdness—are making the most satisfactory returns of any of our factories.

Europe is making progress

"Let me turn to another picture and say a few words about conditions abroad. I have just returned from Europe, having visited Italy, Germany, France and England. France is prosperous, needing more workmen than she has, with no unemployed, and she is bringing in workmen from Italy and Poland. Italy is very poor, competition is keen and profits from industry very meager. She has no natural resources, such as coal, and no abundance of raw material, but plenty of willing labor. She is working hard and her economic condition today is more hopeful than I have seen it in years.

"In Germany taxes are very heavy, unemployment is very great, approximately 3,000,000 being unemployed, and competition is very keen, with returns only fair. Still, with all her burdens of reparations, Germany is making progress, with the will to work on the part of labor, even though wages are low; the management is keen and the factories have been modernized, taking advantage of better methods wherever they may be, visiting this country and elsewhere to see the latest developments and introducing them in the factories, going after world business most persistently and effectively. So the rest of the world must expect keen and intelligent competition on the part of the Germans.

"England has a very difficult situation, with 1,500,000 unemployed, with her coal, steel and other industries disorganized and depressed and with all the world knowing of her troubles, but from my experience and observations I have faith that England will find a way out."

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New York Metal Prices

	April 9, 1930 Cents per Pound	April 16, 1930 Cents per Pound
Copper, electrolytic....	18	14
Lead, Am. S. & R. price	5.50	5.50
Antimony.....	8	7¾
Nickel, ingot.....	35	35
Zinc, spots.....	5.30	5.20
Tin, straits.....	36¼	36¼
Aluminum, 99 per cent	24.30	24.30

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TRADE BRIEFS

Wayland Company, Ltd., has been organized by Clarke E. Wayland, with offices in San Francisco, to specialize in the sale and installation of Johns-Manville products in northern California and western Nevada.

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American Air Filter Company, Inc., Louisville, Ky., has been organized out of the consolidation of the Reed, Midwest and National Air Filter Companies.

•

Electromatic Manufacturing Company, Inc., Newark, N. J., has named O. A. Thomson sales manager.

•

Kelman Electric Supply Company of Rochester, N. Y., has been incorporated with a capital stock of 200 shares of no-par value to deal in electrical wiring, etc. Directors are Max Kelman, Fannie Kelman and Kate M. Butcher, all of Rochester.

Market Conditions

BUSINESS shows substantial improvement in all sections of the country and the demand for electrical equipment is strong. In the East both central station and industrial enterprises report an encouraging outlook.

——MIDDLE WEST AND SOUTHEAST report that conditions are satisfactory, a slow but steady improvement characterizing the present trend.

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EASTERN

—DEMAND FOR ELECTRICAL *equipment continues on an upward grade in the New York market. Commitments are growing in volume both from central stations and industrial interests.*

—INQUIRIES RECEIVED *are more numerous than at any time during the past three months. Equipment manufacturers in many lines, from prime movers to wire and cable, all report that business shows substantial improvement, with outlook good for continuance. Domestic electric apparatus also indicates noticeable betterment.*

Power company orders are rounding out gross totals that compare favorably with those of a year ago. A metropolitan central station has contracted for a quantity of network protectors with a state manufacturer, costing $100,000. A utility company in New Jersey has ordered a quantity of regulators from a New York maker, totaling $40,000. The General Electric Company has secured an order for a 2,000-kw. turbo-generator unit for a municipal power station in Mississippi. The Combustion Engineering Corporation, New York, will build a steam generating unit for the Kips Bay station of the New York Steam Corporation, designed for an output of 325,000 lb. of steam per hour. The Westinghouse Electric & Manufacturing Company will furnish a turbo-generator for a municipality in North Carolina, to cost about $84,000, and has also received an order for switchboard and accessories. A metropolitan power company has purchased a quantity of cable from a New York manufacturer to cost about $75,000. An Indiana central station has placed an order with a New York maker for cable to an amount of $40,000. A producer of transformers for heavy service reports orders from power companies as very satisfactory and reaching sizable totals gross; present business is exceeding that of a year ago at this same time.

A New York railway system has ordered a quantity of insulating material from a state manufacturer, costing $50,000. Another steam line in this territory has purchased a quantity of miscellaneous electrical equipment from a New York maker, totaling $50,000. A manufacturer of electric refrigerating equipment in the Middle West is running on peak schedule and breaking all previous production records; another maker of like apparatus reports that March was the largest month in company history.

CONSTRUCTION PROJECTS

Board of Education, New York, plans four vocational training schools to cost $4,500,000. New York Power & Light Company, Albany, N. Y., plans hydro-electric power plant on Hudson River, near Hadley, to cost over $3,000,000. Pennsylvania Railroad Company, New York, will build loading and distributing pier at Jersey City, N. J., to cost $2,000,000. Public Service Electric & Gas Company, Newark, N. J., has filed plans for a power substation at Elizabeth, N. J., to cost $50,000. State Board of Education, Trenton, N. J., will soon call for bids for power plant in Ewing Township, reported to cost over $150,000. Philadelphia, Pa., will build airport and marine terminal at Hog Island to cost about $6,000,000. Department of Property and Supply, Harrisburg, Pa., will receive bids until May 20 for incandescent lamps. Etna, Pa., will receive bids until April 23 for a 1,000-kw. turbo-generator and auxiliaries for municipal power plant. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids (no closing date stated) for refrigerating equipment.

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SOUTHWEST

—THE PERIOD *of watchful waiting in the electrical industry seems to be bringing its reward in very greatly increased business in the St. Louis district.*

—THE VOLUME OF ORDERS *the past week for all types of materials has been most satisfactory and jobbers report that the week has brought many requests for estimates on large orders.*

The following contract orders were placed: A 60-ton locomotive for a southwest city railway costing $16,000, an order amounting to $13,000 for a motor-generator set which goes to an Illinois coal company, 10,000-kva. transformers, amounting to $30,000, for a power plant in the southwest, and motors costing $7,000 to be used for irrigation purposes in the rice fields in Arkansas.

CONSTRUCTION PROJECTS

Siketon, Mo., has authorized bond issue of $150,000 for municipal electric power plant and system. Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans transmission line and switching station for city service. Barnsdall Corporation, Okmulgee, Okla., will make extensions in oil refining plant to cost over $200,000. Arkansas - Missouri Power Company, Blytheville, Ark., plans transmission lines in Fulton County, to cost over $90,000. San Antonio, Tex., contemplates airport lighting system. Monroe, La., contemplates ornamental lighting system. Wichita Public Elevator Company, Wichita, Kan., will build addition to grain elevator to cost $100,000. Altus, Okla., plans rebuilding of municipal electric light and power plant, destroyed by fire, with loss of $200,000.

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PACIFIC COAST

—ALTHOUGH APRIL *is rated as an outstanding month, business so far has been disappointing, especially from country dealers and contractors.*

—RADIO JOBBERS *and dealers, however, report excellent business, chiefly because of their clearance of superseded types. Ranges are also moving well, largely for the same reason, three carloads having been sold in Los Angeles, two carloads to Portland, and a carload in Seattle during the past week.*

Power company business has fallen off appreciably, though still including such orders as two carloads of bare and weatherproof wire for the San Francisco district, five carloads of 60- and 65-ft. poles for Glendale, a $5,000 pole order for the coast valleys district and a $25,000 Westinghouse generator equipment for Los Angeles. A southern California company has budgeted the early construction of $200,000 worth of substations.

Government buying is brisk and varied, including electric lathes and arc-welding sets for Mare Island navy yard, wire and wiring supplies for various coast barracks and power plants for motor tugs. The government has budgeted $10,000,000 of Pacific Coast buying during 1930, including a $240,000 storage battery equipment and building for Mare Island. Lighting installations include $20,000 worth of special fixtures for the San Francisco civic auditorium, a project for night lighting the San Francisco ball park and large orders for specially sprayed lamps for

color effects in several Paramount theaters. Street-lighting business is fair, with many small installations. Industrial business is still improving, though very little material is being bought by lumber, steel and mining companies. A film company bought Westinghouse motor-generator sets and switchboards aggregating $25,000.

Contracts recommended for awards in connection with steam plant auxiliary No. 2 in Tacoma include fifteen 400- and 500-amp. oil circuit breakers, one 1,600-amp. generating switch and one truck type switchboard, involving about $30,000, to Westinghouse; five 100-kva. transformers to Maloney Electric Company; three 400-amp. current reactors costing about $3,000 to Eicher & Bratt and ten disconnecting switches for about $600 to Pacific Electric & Manufacturing Corporation. Action on boiler bids, ranging from approximately $300,000 to $500,000, is pending. The city commission of Centralia, Wash., will open bids April 29 for completion of the city's million-dollar hydro-electric project on Nisqually River, involving control structure transmission line, substation, power house, forebay, penstock, tailrace, switchboards, oil circuit breakers, transformers, flume and lighting arresters, estimated at approximately $400,000.

Apparatus sales reported include group-operated 73-kv. disconnecting switches, costing about $4,000, for Renton substation; $3,000 worth of miscellaneous switchgear, three 1,000-kw. power transformers and one 300-kva. Diesel generating unit. Motor sales included 30 machines from 75 hp. down to scattered sawmills, ten from 25 hp. down to dealers and two 150-hp. synchronous motors to Weyerhauser lumber mill at Snoqualmie.

CONSTRUCTION PROJECTS

Southern Sierras Power Company, Riverside, Calif., plans power substation at Loma Linda, and will extend present substation at San Jacinto. Bureau of Power and Light, Los Angeles, plans power substation. Los Angeles, Sacramento, Santa Barbara and Newport Beach, Calif., plan ornamental lighting systems. Golden Gate Sardine Company, San Francisco, plans plant to cost $125,000.

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SOUTHEAST

—SATISFACTORY BUSINESS *is reported for the Southeast. The agricultural conditions are somewhat better than at the same time last year and a slow but steady improvement is to be noted in the industrial field. Electrical merchandise lines, except radio, are brisk.*

The largest central-station order reported last week was in Georgia for oil circuit breakers amounting to approximately $100,000. The same company ordered two 3,000-kva., three-phase transformers and 60,000 lb. of bare and weatherproof wire. An Alabama company ordered 90,000 lb. of weatherproof copper wire. Some other central-station orders were for switches amounting to $9,300, aluminum cable totaling $7,100 and recording instruments costing $3,800, the latter equipment going into the Atkinson plant, near Atlanta.

Transformers amounting to $9,000 and control equipment totaling $8,000 have been ordered on a cotton mill electrification in middle Georgia, while wiring materials and fixtures aggregating $9,000 are being ordered in connection with the Georgia State Capitol remodeling. "Whiteway" equipment amounting to $3,000 has been ordered for one of the smaller towns in the section. The Georgia Power Company has purchased the privately owned electric system in Brooklet and will build a substation in and extend 9 miles of transmission line to this town.

CONSTRUCTION PROJECTS

Monongahela West Penn Public Service Company, Fairmont, W. Va., plans transmission lines in Barbour County, including substations. West Virginia Power & Transmission Company, Pittsburgh, Pa., contemplates hydro-electric power plant on Cheat River, W. Va., application now being heard, reported to cost over $2,500,000. Charlotte, N. C., contemplates airport lighting system at proposed municipal airport to cost $250,000. Tennessee Coal, Iron & Railroad Company, Fairfield, Ala., will make extensions and improvements in steel mills to cost over $7,000,000.

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NEW ENGLAND

—SALES OF *electrical equipment are steady. Small orders in a good volume are reported in industrial equipment and central-station supplies. Negotiations are active.*

—DURING THE PAST WEEK *central-station supplies moved more actively. Inquiries for transformers are being received in good order and sales show an encouraging trend for the first quarter. Line material orders are being received.*

Recently several large orders for insulators for northern New England line extensions were placed. Pole and crossarm shipments are regular. Line hardware and cable orders are being placed. On industrial equipment, sales continue at a good level. Small motor orders totaling over $40,000 were noted for the past week and a number of orders for groups of motors were of interest. Fractional-horsepower motor sales are steady. Scheduled material sales are active.

Small switch and control orders are reported in good volume and inquiries are numerous. Service meter sales according to one manufacturer are becoming more active. Heavy industrial equipment is receiving interest and negotiations are progressing favorably for a number of turbo-generators to be placed soon. One order recorded last week included a 2,500-kw. turbo-generator and accessories to be used in an eastern Massachusetts plant.

CONSTRUCTION PROJECTS

Eastern Massachusetts Electric Company, Salem, Mass., plans transmission line to Danvers and vicinity. Edison Electric Illuminating Company, Boston, Mass., will make extensions and improvements in substation at Waltham. Grinnell Company, Inc., Providence, R. I., has plans for fire extinguisher manufacturing plant at Philadelphia, Pa., to cost about $150,000.

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MIDDLE WEST

—GENERAL BUSINESS *in the Middle West section continues practically to mark time. A slight improvement in the volume of business is noticeable, however, this week. Reports emanating from the steel industry indicate a more satisfactory condition, while some improvement in the automotive industry is apparent.*

—AGRICULTURAL IMPLEMENT *manufacturers are receiving their seasonal demand, while mail order sales are holding up relatively well.*

The various railroads, together with the utility companies, are proceeding conservatively and a large amount of necessary work is being started. Some of the interesting orders placed this week include 150,000 ft. of ⅜-in. seven-strand copperweld guy wire, 457 Thompson meters, 5 to 800 amp. capacity, and several construction orders aggregating $75,000.

Jobbers' sales have increased slightly. There has been an excellent demand for electric refrigerators and preparations are being made at this time for a large fan season, one jobber placing an order for electric fans to cost $49,000.

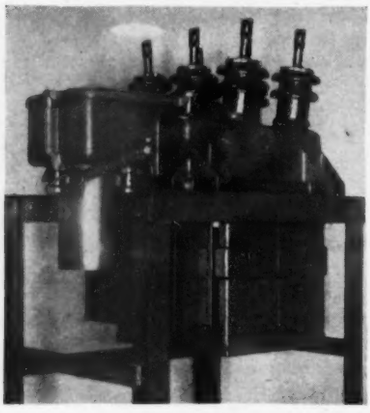
CONSTRUCTION PROJECTS

Milwaukee Electric Railway & Light Company, Milwaukee, Wis., will build power substation at Cudahy. Consumers Power Company, Jackson, Mich., plans equipment repair and service plant at Lansing, to cost $100,000; also, headquarters and service building at Pontiac, Mich., to cost $300,000, and motor rewinding plant at Grand Rapids, to cost $60,000. Commonwealth Edison Company, Chicago, Ill., has filed plans for multi-story addition to equipment service and repair plant to cost $1,000,000. American Steel & Wire Company, Cleveland, Ohio, plans extensions in local Cuyahoga mill to cost $2,000,000. St. Paul, Minn., plans ornamental lighting system. Marshalltown, Iowa, plans extensions and improvements in lighting system to cost $65,000.

New Equipment Available

Mechanically Trip-Free Outdoor Circuit Breaker

AN OIL CIRCUIT BREAKER, type FO-22, recently brought out by the Westinghouse Electric & Manufacturing Company is intended specifically for outdoor



service and will remain weather-proof under the most severe weather conditions, it is claimed. This new breaker is available in two- and three-pole, single-throw sizes, in capacities of 400, 600 and 800 amp., for operating voltages of 7,500 or less and with an interrupting capacity of 3,500 amp. at 7,500 volts. The breaker is designed primarily for pipe or structural steel framework mounting, but can be adapted to wall or pole mounting. It is arranged for either manual, d.-c. solenoid or a.-c. solenoid (d.-c. solenoid-Rectox combination) operation.

The automatic breaker is mechanically trip free at any point of the closing stroke and can be equipped with the following attachments: A maximum of three series trip attachments, having inverse time limit features; three transformer trip attachments, having instantaneous, inverse time limit or direct trip features; a shunt trip attachment, a low-voltage release attachment, a Veeder counter and a four- or six-pole rotary type auxiliary switch.

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Instantaneous or Time-Delay Air Circuit Breakers

A NEW LINE OF "trip-free" air circuit breakers, the principal advantages of which are that they are trip-free from the handle on overcurrent, they have a triple contact, there is no burning on the main brush, the burning tips are easily replaced, the high-pressure main contact is formed of laminations which make "end-on" contact with heavy and uniform pressure, has been placed on the market by the General Electric Company. The breakers are available for either instantaneous or time-delay automatic operation in either single, double, or triple-pole combinations with necessary accessories.

There are three classifications of breakers for voltages of 650 and below. The type CN-1 is a compact breaker applicable to industrial service and for circuits in buildings where the current is from 3 to 300 amp. The type CP-108 is for moderate duty service, rated 1,200 amp. and below, and the type CK-8 is a heavy-current breaker for moderate or heavy-duty service ranging from 1,600 amp. up.

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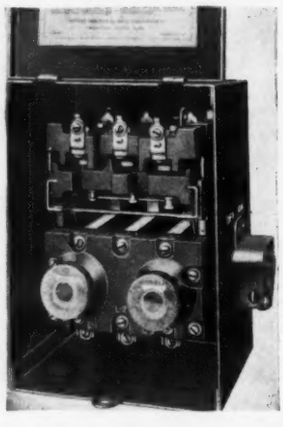
Manually Operated Air Motor Starter

A MANUALLY OPERATED AIR MOTOR STARTER, known as type A-15, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston, Mass. The starter embodies the principle of arc prevention based on contacts of such shape, mass, relation and arrangement with respect to voltage and energy to be absorbed as to reduce the visual evidence of circuit interruption to a spark of negligible importance, even under heavy overloads. The starter contacts are assembled in units on insulated carrier bases, one stationary and the other movable. The movable contact base can be withdrawn



without the use of tools, permitting ready inspection of both movable and stationary contacts. The stationary and movable contacts are identical and interchangeable.

The starter is unusually simple and compact, inclosed in a substantial steel case arranged with conduit knockouts. Thermal cutouts are provided for time-lag overload protection. The type A-15 is furnished for 7½ hp. at 550 and 440 volts, 5 hp. at 220 volts and 3 hp. at 110 volts.

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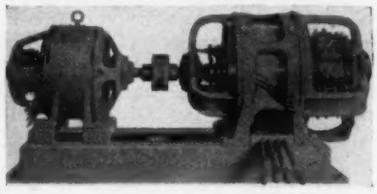
Secures Frequencies Other Than Standard

FREQUENCY CONVERTERS for obtaining frequencies different from those furnished by power companies are announced by the Reliance Electric & Engineering Company, Cleveland, Ohio. These machines are built for operation



in either two-phase or three-phase current. Reliance frequency converters provide an economical method of obtaining single-phase, two-phase or three-phase current at any low frequency, it is claimed, and are especially economical for obtaining very low frequencies, such as 3 to 15 cycles.

These converters have been used to obtain variations in speeds with squirrel-cage induction motors and to get speeds which are either higher or lower than can be obtained from induction motors operating on a standard frequency.

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Individual Relay for Each Lighting Fixture

A NEW STREET-LIGHTING FIXTURE, the "Contactolite," which is unique in that there is an individual relay for each fixture mounted in the fixture itself, has been announced by the Line Material Company, South Milwaukee, Wis.

It is claimed that construction costs are materially decreased due to the elimination of stringing the lamp feed wire from pole to pole and, due to the relay being located in the fixture itself, the voltage drop to the light is greatly diminished, thereby insuring maximum illumination at the minimum circuit voltage. Another advantage is that in case of trouble only one lamp is affected and the outage can be located promptly, whereas in the usual multi-contactor relay scheme the entire group of lights controlled would be disconnected.